Montana Modeling Guideline for Air Quality Permits

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Planning, Prevention & Assistance Division / Monitoring & Data Management Bureau / Analytical Services Section

Preface

Both Industry and regulatory agencies have expressed a need for consistency in the application of air quality models for regulatory purposes. This *Montana Modeling Guideline for Air Quality Permits* (*Montana Modeling Guideline*) presents current Montana Department of Environmental Quality (MDEQ) modeling guidance for estimating impacts from stationary sources of air pollution. This document addresses modeling issues for sources of air pollution ranging from small minor sources to major sources subject to the Prevention of Significant Deterioration (PSD) and Nonattainment Area (NAA) permitting programs.

The guideline is intended to help permit applicants, air quality specialists, and others understand MDEQ's expectations for ambient air impact analyses and to prevent unnecessary delays in the permitting process. To avoid any misunderstandings, the most recent version of the *Montana Modeling Guideline* should be used in conjunction with the current regulations and applicable U.S. Environmental Protection Agency (EPA) documents. The latest version may be obtained on the MDEQ's website http://www.deq.state.mt.us/ppa/mdm/ModelingGuidelines.pdf . Overall, the *Montana Modeling Guideline* contains general guidance that does not change frequently. It is intended to promote technically sound and consistent modeling techniques to help permit applicants decide when it is necessary to submit modeling, and what modeling related information and data should be included with a permit application.

The use of models and procedures other than those recommended here and in related Montana and EPA guidance must be approved by MDEQ, and in some instances, EPA approval may also be necessary. Furthermore, recommendations in the *Montana Modeling Guideline* may not be applicable in all situations.

This document does not have the force and effect of a rule and is not intended to supersede statutory or regulatory requirements or recommendations of EPA. In general, the procedures in the EPA document *Guideline on Air Quality Models* (Appendix W of 40 CFR Part 51) should be followed when conducting the modeling analysis. In cases of contradictions between these guidelines and the EPA documents or the Administrative Rules of Montana (ARM), the EPA documents and the ARM prevail.

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Glossary of Acronyms and Symbols

AERMOD	AMS/EPA Regulatory Model
AIRS	Aerometric Information Retrieval System
AMS	American Meteorological Society
AQCR	Air Quality Control Region
AQRV	Air Quality Related Value
ARM	Administrative Rules of Montana
AWMB	Air and Waste Management Bureau
BACT	Best Available Control Technology
BPIP	EPA's Building Profile Input Program
CFR	Code of Federal Regulations
CO	carbon monoxide
DEM	digital elevation model
EPA	U.S. Environmental Protection Agency
FCAA	Federal Clean Air Act
FIA	full impact analysis
FLM	Federal Land Managers
GAQM	EPA's Guideline on Air Quality Models
GEP	good engineering practice
g/s	grams per second
HAP	hazardous air pollutant
H_2S	hydrogen sulfide
H_b	building height
HTTP	hypertext transfer protocol
ISC	EPA's Industrial Source Complex model
ISCLT	ISC long-term model
ISCST	ISC short-term model
ISC-PRIME	ISC-plume rise model enhancements model
K	degrees Kelvin
km	kilometer(s)
L	lesser of the building height or maximum projected width
MAAQS	Montana Ambient Air Quality Standards
MCA	Montana Code Annotated
MCAA	Montana Clean Air Act
MDEQ	Montana Department of Environmental Quality
MDMB	Monitoring and Data Management Bureau

m	meter(s)
m/s	meter(s) per second
m^3/s	cubic meter(s) per second
$\mu g/m^3$	microgram(s) per cubic meter
NAA	nonattainment area(s)
NAAQS	National Ambient Air Quality Standard(s)
NCDC	National Climatic Data Center
NSR	New Source Review
NWS	National Weather Service
NO	nitrogen oxide
NO_x	nitrogen oxides
NO_2	nitrogen dioxide
O_3	ozone
OLM	Ozone Limiting Method
Pb	lead
PC	personal computer
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
RAM	three-letter designation for a Guassian-plume, multiple source model
RAMMET	meteorological preprocessor developed for the RAM model
RFP	reasonable further progress
SCRAM	EPA’s Support Center for Regulatory Air Models
SIA	significant impact analysis
SIP	State Implementation Plan
SO_2	sulfur dioxide
tpy	ton(s) per year
USGS	United States Geological Survey
UTM	Universal Transverse Mercator projection
VOC	volatile organic compound
§	section

Definitions

Note: The following explanations of terms are included solely for the readers' convenience; they do not take the place of any full, formal definition in state or federal laws, rules, or regulations.

Air Pollutants - One or more air contaminants that are present in the outdoor atmosphere.

Air Quality-Related Value (AQRV) - A term used by the National Park Service that includes visibility, odor, flora, fauna; geological resources; archeological, historical, and other cultural resources; and soil and water resources.

Ambient Air - It is that portion of the atmosphere, external to buildings, to which the general public has access.

Appendix W of 40 CFR Part 51- Guideline on Air Quality Models - Recommended air quality modeling techniques that should be applied to State Implementation Plan (SIP) revisions for existing sources and to New Source Reviews (NSR), including Prevention of Significant Deterioration (PSD) and Nonattainment Area (NAA). EPA intends it for use in judging the adequacy of modeling analyses performed by EPA, State and local agencies, and industry. The Guideline identifies those techniques and databases EPA considers acceptable and it serves as a basis by which air quality managers supported by sound scientific judgement, have common measures of acceptable technical analysis.

Class I Area - An area defined by Congress that is afforded the greatest degree of air quality protection. Class I areas are deemed to have special natural, scenic, or historic value. The PSD regulations provide special protection for Class I areas in which little deterioration of air quality is allowed.

Class II Area - An area defined by Congress where moderate deterioration of air quality associated with well-managed industrial growth is allowed.

Class III Area- An area defined by Congress which have the largest increment and thereby provide for a larger amount of development than either Class I or Class II areas.

Complex Terrain - Complex terrain is any terrain exceeding the height of the stack being modeled. This definition includes terrain that is commonly referred to as intermediate terrain, that is, those receptors between stack height and plume height.

Criteria Pollutant - A pollutant for which a national ambient air quality standard has been defined (SO_2, NO_2, PM_{10}, Pb, CO, O_3).

Digital Elevation Model (DEM) - An array of elevations, usually at regularly spaced intervals, for a number of ground positions.

Federal Land Manager (FLM) - The federal official directly responsible for the national parks, national wildlife refuges, and national forests (e.g., park superintendents, refuge managers, and forest supervisors, respectively) derive their responsibility from the respective agency organic acts. Furthermore these officials and the FLM for their respective agencies, have an affirmative responsibility under Section 165 of the CAA to protect and enhance the AQRVs of Class I areas from adverse effects of air pollution.

Hazardous Air Pollutant (HAP) - Any pollutant subject to a standard promulgated under FCAA, §112 (relating to hazardous air pollutants).

Increment - The maximum permissible level of air quality deterioration that may occur beyond the baseline air quality level. Increment is consumed or expanded by actual emissions changes occurring after the baseline date and construction related actual emissions changes occurring after January 6, 1975 for particulate matter and sulfur dioxide, and after February 8, 1988 for nitrogen dioxide.

Isopleth - A line on a map connecting points where a given variable has a specified constant value.

Major Source - The term major may refer to the total emissions at a stationary source or to a specific facility. For PSD review, once a site or project is major for one pollutant, all other pollutant's emissions are compared to significance levels in 40 CFR 52.21(b)(23).

- A named major source is any source belonging to a list of 28 source categories in 40 CFR 52.21(b)(1) which emits or has the potential to emit 100 tons-per-year (tpy) or more of any pollutant regulated by the FCAA.
- A major stationary source is any source not belonging to the 28 named source categories which emits or has the potential to emit such pollutants in amounts of 250 tpy or more.
- A major source is any source that emits 10 tpy or more of any single HAP or 25 tpy or more of any combination of HAPs under FCAA §112(b).

Major Modified Stationary Source or Facility - Used in the context of a PSD or Nonattainment permit application, the phrase major modified stationary source or facility refers to a change in operation that results in a significant net increase of emissions for any pollutant for which a NAAQS has been issued. New sources at an existing major stationary source are treated as modifications to the major stationary source.

Major Source Baseline Date - For particulate matter and SO_2 the major source baseline date is January 6, 1975 and for NO_2 it is February 8, 1988 [40 CFR 52.21(b)].

Minor Source - As used in this document, a minor source is any stationary source that is not defined as a major stationary source by ARM 17.8.801(22)(a). The term is sometimes used rather loosely and the definition may vary based on the context in which it is used.

Minor Source Baseline Date - The earliest date after the trigger date on which a major stationary source or a major modification subject to PSD regulations submits a complete application [40 CFR 52.21(b)].

Model - A quantitative or mathematical representation or a simulation that attempts to describe the characteristics or relationships of physical events (GAQM).

National Ambient Air Quality Standards (NAAQS) - Levels of air quality to protect the public health and welfare (40 CFR §50.2).

National Geodetic Vertical Datum of 1929 - Reference surface established by the U.S. Coast and Geodetic Survey in 1929 as the datum to which relief features and elevation data are referenced in the conterminous United States; formerly called "mean sea level 1929."

Nearby Sources - A nearby source is any major source or minor source that causes a significant air pollutant concentration gradient in the vicinity of a new or modified source.

Nonattainment - Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for a criteria pollutant.

North American Datum of 1927 (NAD27) - NAD27 is defined with an initial point at Meads Ranch, Kansas, and by the parameters of the Clarke 1866 ellipsoid. The location of features on most USGS topographic maps, including the definition of 7.5-minute quadrangle corners, is referenced to the NAD27.

North American Datum of 1983 (NAD83) - NAD83 is an Earth-centered datum and uses the Geodetic Reference System 1980 (GRS 80) ellipsoid, unlike NAD27, which is based on an initial point (Meads Ranch, Kansas). Using recent measurements with modern geodetic, gravimetric, astrodynamic, and astronomic instruments, the GRS 80 ellipsoid has been defined as a best fit to the worldwide geoid. Because the NAD83 surface deviates from the NAD27 surface, the position of a point based on the two reference datums will be different.

Other Background Sources - Other background sources include all sources of air pollution other than the source under review and those identified as nearby sources. Examples include area and mobile sources, natural sources, most minor sources, and distant major sources. They are generally accounted for by using an appropriate ambient background concentration as recommended in § 9.2.2 of Appendix W of 40 CFR Part 51 or by application of a model using inventory recommendation in Table 9-2 of Appendix W.

Primary Standard - A pollution standard based on human health effects. Primary standards are set for criteria pollutants.

Receptor - A location where the public has access and could be exposed to an air contaminant (or pollutant) in the ambient air.

Refined Model - An analytical technique that provides a detailed treatment of physical and chemical atmospheric processes, and requires detailed and precise input data. Specialized estimates are calculated that are useful for evaluating source impact relative to air quality standards and allowable increments. The estimates are more accurate than those obtained from conservative screening techniques (GAQM).

Screening Technique - A relatively simple analysis technique to determine whether a given source is likely to pose a threat to air quality. Concentration estimates from screening techniques are conservative (GAQM).

Secondary Standard - An air pollution limit based on environmental effects, e.g., damage to property, plants, visibility, etc. Secondary standards are set for criteria air pollutants.

Significant Impact - A concentration in ambient air that exceeds a modeling significance level.

Unclassifiable - Any area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant.

Trigger Date - The date after which the minor source baseline date may be established. It is August 7, 1977 for particulate matter and SO_2 and February 8, 1988 for NO_2 [40 CFR 52.21(b)].

Universal Transverse Mercator (UTM) - The UTM system is a plane coordinate system that uses distances from a specified reference point as the basis for all locations. It is based on a traverse Meracator projection that divides the Earth's surface into zones, each spanning six degrees of longitude and oriented to a meridian. Precise locations are described in terms of north-south (northing) and east-west (easting) distances, measured in meters from the origin of the appropriate UTM zone. This projection preserves angular relationships and scale plus it easily allows a rectangular grid to be superimposed on it. Many worldwide topographic and planimetric maps at scales ranging between 1:24,000 and 1:250,000 use this projection.

World Geodetic System 1972 (WGS 72) - The definition of Defense Mapping Agency (DMA) DEMs, as presently stored in the USGS database, references the WGS 72 datum. WGS 72 is an Earth-centered datum. The WGS 72 datum was the result of an extensive effort extending over approximately three years to collect selected satellite, surface gravity, and astrogeodetic data available throughout 1972. These data were combined using a unified WGS solution (a large-scale least squares adjustment).

World Geodetic System 1984 (WGS 84) - The WGS 84 datum was developed as a replacement for WGS 72 by the military mapping community as a result of new and more accurate instrumentation and a more comprehensive control network of ground stations. The newly developed satellite radar altimeter was used to deduce geoid heights from oceanic regions between 70 degrees north and south latitude. Geoid heights were also deduced from ground-based Doppler and ground-based laser satellite-tracking data, as well as surface gravity data.

1.0 Introduction

This document focuses on the application of air dispersion models and general procedures for meeting the air permitting requirements of Montana Department of Environmental Quality (MDEQ). It is assumed that the reader has a basic knowledge of modeling theory and techniques.

The primary U.S. Environmental Protection Agency (EPA) modeling guideline is Appendix W of 40 CFR Part - ***Guideline on Air Quality Models*** (GAQM). There are other associated EPA guidance documents, EPA model user guides, and EPA model clearinghouse decisions that explain modeling procedures. Also, Federal Land Managers (FLMs) publish modeling guidance documents. This guideline, as applied to individual modeling projects, provides a minimum level of analysis to be used to demonstrate that the public's health, general welfare, and physical property are protected. In addition, this guideline provides consistency in the selection and application of air dispersion models to ensure a common basis for estimating pollutant concentrations, assessing control strategies, and specifying emission limits - without compromising accuracy.

These general procedures are updated as necessary. The applicant is responsible for determining current modeling procedures between formal publications of this document.

1.1 What is Air Dispersion Modeling?

Air dispersion modeling is a tool used to predict concentrations from one or more sources of air pollution. There are a wide variety of air dispersion models that have been developed for different pollution sources, meteorology, downwind distances, and other factors that affect how pollutants are dispersed in the atmosphere. In general, all of these models require two types of data: information about the source being modeled, including the pollutant emission rate, and information about the dispersing characteristics of the meteorology surrounding the source, such as wind speed and direction. The model uses this information to mathematically simulate the pollutant's downwind dispersion in order to derive estimates of concentration at a specified location (receptor). Some models even simulate the chemical transformations and removal processes that can occur along the transport path.

Air dispersion models are most frequently used during the permitting process to verify that a new source of air pollution will not exceed federal health-based standards. These standards, called the National Ambient Air Quality Standards (NAAQS), were established by the Federal Government to protect human health and the environment. Montana has also established standards that are called the Montana Ambient Air Quality Standards (MAAQS). Models are used to estimate downwind concentrations from a proposed facility and the results are compared to the NAAQS and MAAQS prior to its construction.

Agency personnel use the results from these models in their review of air quality permit applications. Modeled predictions are one of the many parameters considered in the technical review process. However, a modeled prediction of an exceedance of an ambient standard may be used as the basis to modify permitted allowable emission rates, stack parameters or operating conditions, or require a State Implementation Plan (SIP) review for criteria pollutants.

1.2 Guidance Philosophy

This document is a guide to typical air dispersion modeling techniques and procedures. It expands on modeling procedures contained GAQM and associated EPA guidance, EPA models user guides, and guidance and modeling related memos and information available from EPA's Support Center for Regulatory Air Models (SCRAM) internet site (http://WWW.epa.gov/scram001). MDEQ's goal is to use worst-case assumptions and conditions to conduct the minimum amount of modeling necessary to demonstrate that the modeled sources should not cause or contribute to an exceedance of an ambient standard or increment.

If the modeler can demonstrate that techniques other than those recommended in this document are more appropriate, then MDEQ may approve their use. However, methods that deviate from this document and/or the GAQM should be discussed with the MDEQ prior to conducting a modeling analysis. It is highly recommended that these methods be documented through the use of a protocol to prevent any misunderstandings. Any demonstration that deviates from recommended procedure must at a minimum be documented in the air quality analysis.

Periodically, the MDEQ develops new techniques or changes procedures to reflect improvements in regulatory models, to correct deficiencies that have been discovered, or to be consistent with requirements of other regulatory agencies. These changes to standard practices and other useful information will be placed on MDEQ's Internet page http://www.deq.state.mt.us/ppa/index.asp.

1.3 Sources Required to Perform Air Dispersion Modeling

New sources, or a significant modification to an existing source, may require air dispersion modeling. The purpose of the modeling analysis is to demonstrate that compliance with the NAAQS, MAAQS, and as appropriate Prevention of Significant Deterioration (PSD) increments, will be met after a proposed construction or modification of a source has taken place. An air quality preconstruction permit may not be issued to a new or altered source unless the applicant demonstrates that the source and/or stack can be expected to operate in compliance with the standards and rules adopted under the Montana Clean Air Act (MCAA), the applicable regulations and requirements of the Federal Clean Air Act (FCAA), and any applicable control strategies contained in the Montana State Implementation Plan (SIP), and that it will not cause or contribute to a violation of the MAAQS [Administrative Rules of Montana (ARM) 17.8.710(2)].

The extent of the required modeling necessary will vary from one source to another. For a new or modified source, performing simple screening techniques, such as the use of the SCREEN3 model or other applicable screening models may demonstrate compliance. **If compliance can be demonstrated using an approved screening model, no further modeling will be required.**

Sources that cannot demonstrate compliance using screening techniques are required to perform an analysis using a more refined model(s) with representative meteorological data. Complex multi-point emitting sources, or sources with unusual pollutant dispersion environments for which screening techniques are not applicable, must also use a more refined modeling technique (Refer to the *SCREEN3 Model User's Guide* for the requirements for combined stack modeling).

1.4 Emission Rates that Trigger Modeling

The intent of this section is to describe how an applicant may determine if air dispersion modeling is necessary. This section does not apply to the following permit applications: PSD, incinerator, open burning, portable source, or sources located in or near nonattainment areas (NAAs). For the previous mentioned cases, modeling will be conducted as specified by rule, policy, or determined on a case-by-case basis.

In general, modeling will not be required for minor sources applying for a new permit or for existing sources applying for a permit alteration, if the entire facility's proposed allowable emissions are less than the thresholds identified in Table 1.1. However, modeling may be required regardless of the proposed change if there is reason to believe the source will cause or contribute to a violation of the NAAQS, MAAQS, or other applicable regulations. For instance, facility-wide modeling may be necessary regardless of the change in emissions if there is **not** an approved facility-wide analysis on file with MDEQ. Modeling may also be required when there is a significant change in the dispersion characteristics of the source, even if the modification results in a decrease of emissions.

Table 1.1 Emission Threshold Limits Used to Determine if Modeling is Required

Pollutant	Threshold (tons/yr)
Particulate Matter < 10µm (PM_{10})	50
Sulfur Dioxide (SO_2)	50
Nitrogen Dioxide (NOx)[a]	100
Carbon Monoxide (CO)[b]	100
Volatile Organic Compound (VOC)[c]	No Modeling Required

a. Modeling for mobile NOx sources will be on a case-by-case basis.
b. If NOx modeling is conducted on the same emission point, then CO modeling will not be required.
c. Modeling for hazardous air pollutants (HAPs) will be on a case-by-case basis.

If the facility's allowable emissions are above the threshold identified in Table 1.1, dispersion modeling is required. An applicant must demonstrate that any proposed net emissions increase, a change in the plume rise, or dispersion characteristics of any existing emissions source does not cause or contribute to a violation of the MAAQS or NAAQS. The model must show that the new or modified source(s) will not cause or contribute to a modeled violation of the applicable MAAQS, or increase the frequency or severity of a preexisting modeled violation of a standard.

If the total allowable emissions do not exceed the threshold values and the departmental review indicates no problems associated with the emissions increase then modeling is **not** required for any new facility. Modeling will **not** be required for any existing facility that proposes to increase their allowable emissions unless the cumulative increases in allowables since the last modeling exercise exceeds a threshold value or the departmental review indicates a problem associated with the emissions increase.

For example, if a new particulate emitting facility requests a permit to construct two 20 tons per year (tpy) allowable particulate emitting units, modeling would not be required (i.e., 40 tpy < 50 tpy). However, if this same facility proposes to permit a third 20 tpy particulate emitting unit, then the 50 tpy threshold would be exceeded and the entire facility would have to be modeled. Subsequent modeling would not be required for this facility until a permit alteration increases the allowable particulate emissions above 110 tpy (110 - (20 + 20 + 20) = 50). At that time, the modeling should include all particulate emissions from the existing emitting units at the facility.

Sources required to perform modeling must submit the analysis with their permit application. The application for major sources subject to PSD review must include a satisfactory modeling analysis to be ruled complete.

1.5 Major Sources Within 10 Kilometers of a Class I Area

Any net emissions increase of a regulated pollutant at a major stationary source located within 10 kilometers (6.2 miles) of a Class I area should perform modeling to determine if a maximum 24-hour average impact in the Class I area exceeds 1.0 microgram per cubic meter ($\mu g/m^3$) on a 24-hour basis. If it does, the emission increase is considered significant and the modification constitutes a major modification subject to PSD review (ARM 17.8.801).

The Class I significance level of 1.0 $\mu g/m^3$ on a 24-hopur basis is only intended to determine if a modification is major. It should not be used to determine if the impact in a Class I area is significant.

1.6 Exemptions from Modeling

Modeling is not generally required for the following situations:

a. Sources exempt from preconstruction permitting requirements;
b. Sources not required to obtain a preconstruction permit;
c. Emergency and backup generators - Modeling is not routinely required for emergency backup generators. It may be required if the equipment could be operated in a way that might result in a violation of an ambient standard; and

d. A revision to a permit or a permit condition is generally exempt from modeling as long as it does **not** involve a modification such as a physical change (e.g., addition of new equipment), a change in the method of operation (e.g., production increase), a change that would increase emissions, or a change in the dispersion characteristics.

2.0 The Air Quality Analysis Process

The air quality analysis is an evaluation of the potential impact of a new facility or source modification on the environment. Analyses are conducted for state and federal permits; analyses for federal permits are usually more detailed than those for state permits. Because there are several terms, such as the term "source," that have different state, federal, and modeling usage definitions, the process may be confusing. A misunderstanding of the terms could lead to an incomplete analysis. Therefore, applicants and staff should ensure that when using these terms the context of usage is understood by referring to the "Definitions" section.

The air quality analysis process may involve a number of MDEQ staff, depending on the complexity of the application and the potential impact of the associated facility or source on air quality. The permit engineer determines the need for modeling and the scope of involvement of other MDEQ staff. Therefore, the applicant should contact the permit engineer for guidance before other MDEQ staff become involved in the air quality analysis process.

2.1 Permit Engineer Coordination

The applicant should provide sufficient information to the permit engineers so that they are able to determine the need for regulatory modeling. Regulatory modeling is any air dispersion modeling requested by the permit engineer that is used in the permitting process.

2.2 Monitoring and Data Management Bureau Responsibilities

The Analytical Services Section of the Monitoring and Data Management Bureau (MDMB) reviews all air dispersion modeling submitted to MDEQ. Other responsibilities of the MDMB include:

- Providing technical guidance for the modeling process to staff, applicants, and the public;

- Reviewing modeling performed by applicants, permit engineers, or performing modeling in support of a permit application;

- Evaluating the technical quality of air quality analyses submitted by applicants by ensuring that predicted concentrations accurately represent potential impacts, demonstrate compliance with federal and state regulations and guidelines, and can be used by the staff in the technical review process;

- Helping small business applicants meet modeling requirements needed to obtain a permit, or perform modeling for them as necessary; and

- Providing modeling support for other agency needs such as enforcement, pollution prevention, SIP development, or Superfund activities, as directed.

2.3 Guidance Meetings, Protocols, and Checklists

Guidance meetings are optional but are recommended for preconstruction permits requiring modeling and for all PSD permit applications. To schedule a meeting, contact the permitting engineer assigned to the facility or the Permitting Section Supervisor in the Air & Waste Management Bureau (AWMB). The meeting may be conducted in-person with modelers, engineers, and other applicable staff.

Protocols and modeling guidance checklists serve as outlines of how modeling analyses should be conducted; however, they are generally not mandatory. A protocol or checklist may be helpful to an inexperienced permit modeler, or if the permit modeler is proposing new modeling techniques or changes to normal modeling practices. A protocol contains more detail than a checklist. The checklist contains similar data but prompts the modeler rather than providing detailed instructions. Appendix A contains MDEQ's checklist for conducting air dispersion analyses.

MDEQ encourages applicants to submit protocols instead of checklists for PSD and complex state permit modeling projects. In addition, the MDEQ recommends that the applicant does not conduct the regulatory modeling before MDEQ staff reviews the checklist or protocol, and provides comments in order to conserve time and resources.

3.0 Model Selection and Application

In general, model selection and application should be consistent the GAQM and associated EPA guidance, EPA models user guides, and guidance and modeling related memos and information available from EPA's SCRAM internet site (http://WWW.epa.gov/scram001) [1]. Dispersion models previously approved by EPA for use in regulatory modeling analyses, and the supporting documentation, are available to the public free of charge, via the SCRAM site.

Although the GAQM was developed to address PSD and SIP modeling issues, the MDEQ applies the general guidance contained in the GAQM to other modeling demonstrations in order to maintain a consistent approach for all projects. Procedures and models other than those recommended by EPA or in this guideline may be approved on a case-by-case basis if there is sufficient technical justification; however, EPA approval may also be necessary in some instances. Refer to EPA guidance for the use of alternative models.

Permit applicants should consult with MDMB modeling staff prior to the selection of a particular model(s) in order to ensure that its use is appropriate for the type of analysis being performed. MDEQ accepts the use of EPA preferred models for regulatory analyses. Models which do not fall under the category of "EPA approved models" as defined in the GAQM, are subject to the approval by MDEQ prior to their use in a regulatory modeling analysis. If a non-EPA approved model is proposed, then nature and the requirements of such a model should be outlined to MDEQ at a pre-application meeting. A modeling protocol is the preferred method to gain approval. All modeling analyses must demonstrate compliance with standards and increments on simple terrain, intermediate terrain, and complex terrain areas.

The most recent version of EPA-approved models must be used. Using older version models require MDEQ approval, unless an approved protocol is already in place for the modeling project or application.

For dispersion modeling within a 50-kilometer (km) (31 miles) radius of the modeled source, the EPA recommends using steady-state Gaussian plume models such as SCREEN3, ISCST3, ISC3-PRIME, and AERMOD. The ISC3, SCREEN3, and ISC3-PRIME models incorporate the COMPLEX1 source code to allow users to evaluate pollutant impacts in simple, intermediate, and complex terrain during a single execution of the model. AERMOD accounts for all terrain types but currently does not incorporate open pit sources, deposition, or use the PRIME building downwash algorithm. However, upgrades to handle these situations are currently in progress.

The use of a steady-state Gaussian plume model beyond a distance of 50 km may produce overly conservative results. Steady-state modeling results will be accepted for receptor distances beyond 50 km, as a conservative screening method (i.e., modeling results predict concentration

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[1] The SCRAM website is the EPA source of information on air dispersion models. Documentation and guidance for the air dispersion models and related programs are a major feature of the website.

levels less than the applicable standard). For dispersion modeling beyond a distance of 50 km, EPA recommends the use of a Gaussian puff superposition model called CALPUFF.

3.1 Modeling Protocols

Before conducting a refined modeling analysis, it is recommended that permit applicant submit a written modeling protocol detailing the modeling analysis methodology to the Analytical Services Section of the MDMB. The protocol is the primary mechanism used by all affected parties such as the applicant, MDEQ, EPA, and FLMs to reach agreement on a specific modeling approach. The protocol development process is intended to minimize the chances of misunderstandings and to avoid delays during the permit process. It explains in detail how a modeling analysis will be performed, how the results will be presented, and how compliance with the applicable requirements will be demonstrated.

Protocols are generally required for modeling to support risk assessments, non-steady state or a non-guideline model, and PSD applications. Submission of a modeling protocol is recommended for:

- New sources and modifications subject to PSD requirements;

- Complex new sources or modifications such as mining operations and complex industrial facilities; and

- New sources or modifications in nonattainment areas where a reasonable further progress (RFP) and positive net air quality benefit modeling analysis are required by ARM 17.8.905 and 17.8.906.

Consult with the appropriate MDEQ staff to determine if a protocol is required or recommended. In most cases, MDEQ will encourage a submittal of a protocol but will not make it a strict requirement.

3.2 Proprietary Models and Software

The MDEQ recognizes the use of proprietary software (user-friendly) in regulatory analyses. The MDEQ may require applicants to submit software and source codes to aid in the review of the analysis. If these programs are used, check to determine if MDEQ has a copy of the software or if it is necessary to submit a copy with the analysis. The MDEQ recognizes the ownership right of all proprietary software, and therefore cannot release any proprietary models, support software, or documentation to the public without prior approval of the software vendor. Applicants are encouraged to contact software vendors with any questions regarding specific operations of proprietary software.

3.3 Data Submitted is not Proprietary

Any source characteristic, meteorological, terrain, topographical, or other model input data submitted to MDEQ in support of a modeling analysis is considered part of the public record and will be available to the public.

4.0 The Air Dispersion Modeling Analysis

The air quality analysis is an evaluation of the impact on the environment of increased emissions from a new facility or modified source based on the predicted concentrations obtained through modeling.

4.1 Levels of Modeling Used in the Air Quality Analysis

There are two levels of modeling complexity used in the air quality analysis process: screening and refined. Modeling results from either level, as appropriate, may be used to demonstrate compliance with the ambient standards or increments.

4.1.1 Screening Modeling

The first level of complexity involves the use of screening procedures or models. Screening models are used to simulate an absolute worst case condition (i.e., highest predicted impact). These models take less computer time and are more conservative than refined models. Screening models use simple algorithms and conservative techniques to indicate that more detailed modeling is necessary.

Screening models are usually designed to evaluate a single source or sources that can be merged (Section 4.6). Multiple sources can be modeled individually and then the maximum concentration from each source is summed for an overall estimate of the facility-wide maximum concentration. This technique is conservative since the concentrations from each source are added without regard of distance to the maximum impact. Section 6.5 contains factors to convert one-hour concentrations to other averaging periods.

The screening analysis should be performed in a manner consistent with guidance contained in the GAQM, and appropriate screening modeling guidance documents, such as the *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources* (EPA 450/R-92-019). The SCREEN3 model is available for download from the EPA's SCRAM Internet page at http://www.epa.gov/scram001.

4.1.2 Refined Modeling

Refined modeling is necessary if the screening analysis results predict concentrations from the evaluated sources that could exceed a standard, a de minimis level, or a staff-identified percentage of a standard. It is usually the applicant's responsibility to perform refined modeling. However, the permit engineer may ask the MDMB’s Analytical Services Section to perform this type of modeling under certain circumstances, such as for small businesses that cannot afford the costs associated with refined modeling.

This second level of modeling requires more detailed and precise input data and uses more complex models in order to provide refined concentration estimates. The primary model used is the EPA's Industrial Source Complex (ISC) model, which is available for download from the EPA's SCRAM Internet page.

4.2 Types of Air Quality Analyses

The type of air quality analysis depends on the category of permit and pollutants to be evaluated. Several types of analyses may be required for a single permit. There are two general categories of preconstruction permits: those subject to PSD or NAA review and those subject to general preconstruction requirements (minor new source review). For PSD or NAA permits several analyses may be required such as NAAQS/MAAQS, increment, monitoring, ozone ambient impact, Class I/Class II area impacts, and additional impact. For permits subject to Subchapter 7 permitting requirements, the analyses may include NAAQS/MAAQS, increment, and human health risk assessments. Before conducting any analysis, a modeling emissions inventory must first be developed.

4.3 Modeling Emissions Inventory

The modeling emissions inventory consists of the emission points of the sources to be permitted, as well as other applicable on- and off-property emission points, including exempt and grandfathered sources. These points are usually referred to as "sources" in air dispersion modeling guidance documents. Modeling parameters for off-property sources can be obtained from the Air & Waste Management Bureau (AWMB) staff (in the form of a retrieval from the EPA's Aerometric Information Retrieval System (AIRS) database). In some cases, neighboring source data from other states may be required. The AWMB can provide some data for neighboring states, but the applicant is responsible for verifying any missing data with the other states. Any suspicious data within the retrieval should be brought to the attention of the AWMB.

4.4 Ratio Techniques

Since predicted ambient air quality impacts from a source are proportional to its emission rate, it may be appropriate to use a ratio technique to simplify the evaluation of on-property sources and/or to reduce the number of pollutants requiring individual refined modeling runs to a manageable number. Refer to Appendix B for a description of two ratio techniques. Other techniques may be approved on a case-by-case basis**.** The applicant should document in the modeling checklist or protocol, and in the air quality analysis, the rationale for the choice of a ratio technique.

4.5 NO_2 Emissions

Often emission factors and modeled concentrations are based on NOx emissions while the emission standards are based on $NO_{2.}$ Because the modeled NOx concentrations appear to exceed the NO_2 standards, a tiered screening approach is recommended to obtain annual averages of NO_2 from point sources. For Tier 1 (the initial screen), an approved model should be used to estimate the maximum annual average concentration and assume a total conversion of NO to NO_2. If the concentration exceeds the NAAQS/MAAQS, and/or the PSD increments then the applicant should proceed to the Tier 2 (second level) analysis, which multiplies the Tier 1 estimates by an empirically derived NO_2/NOx value of 0.75 (annual national default) (Chu and Meyer, 1991). This method is called the Ambient Ratio Method and is outlined in Appendix C of this document as well as the GAQM.

MDEQ will also accept the Ozone Limiting Method (OLM) to demonstrate compliance for the 1-hr NO_2 MAAQS. Refer to Appendix C for instructions and acceptable assumptions to apply this method.

4.6 Merging of Stack Emission Points

Regulatory modeling should reflect the actual characteristics of the proposed or existing emission points. Therefore, emission points should not be merged except in well-justified circumstances. For example, merging may be appropriate when the number of points at a large site exceeds the capability of the model. Modeling convenience or the desire to reduce model run time is not an acceptable justification.

Merging stacks may be appropriate for both screening and refined analyses if the individual emission points emit the same pollutant(s); have stack heights, volumetric flow rates, or stack gas exit temperatures that do not differ by more than about 20 percent; and are within about 100 meters of each other.

Use the following equation (EPA, 1992) to determine the worst-case stack:

$$M = \frac{h_s * V * T_s}{Q}$$

Where:

- M = a parameter that accounts for the relative influence of stack height, plume rise, and emission rate on concentrations
- h_s = the physical stack height (m)
- V = stack gas flow rate in (m^3/s)
- T_s = the stack gas exit temperature in degrees Kelvin (K)
- Q = pollutant emission rate (g/s)

The stack that has the lowest value of M is used as a “representative” stack. The sum of the emissions from all stacks is assumed to be emitted from the representative stack; that is, the stack whose parameters resulted in the lowest value of M.

For sources located more than 10 km past the radius of impact, all stacks at the facility may be considered as one stack. This stack should be modeled with the parameters of the stack with the lowest value of M as the “merging” stack, regardless of the differences in parameters and distance between stacks at the facility.

4.7 Design Concentration

Refer to the GAQM (e.g., § 8.2.1 and 11.2.3) to determine whether the “high” or “high second-high” or some other concentration value should be used in the NAAQS, PSD increment, and similar compliance demonstrations. The highest concentration should be used for all averaging periods when comparing impacts to modeling significance levels.

Generally, the first high is used for all annual periods and the “high second-high” is used for periods less than one year. PM_{10} is an exception where the “high 6th-high 24-hr average” and the highest five-year average for the annual value are used.

5.0 Conducting the Air Dispersion Modeling Analysis

As stated before, the type of air quality analysis to be performed depends on the category of permit and pollutants to be evaluated. There are two general categories of preconstruction permits: those subject to NSR, PSD, or NAA and those subject to general preconstruction requirements (minor new source review). The type of preconstruction permit determines whether the entire facility must be modeled for compliance with NAAQS and MAAQS for a given pollutant or if only the modified source(s) must be modeled for a given pollutant. It is recommended that MDEQ be contacted prior to conducting any modeling to ensure that the modeling analysis includes the required source(s).

As recommended by EPA (EPA, 1990) for PSD and NAA sources, the dispersion modeling analysis usually involves two distinct phases. The first phase is the preliminary analysis and the second phase is the full impact or the cumulative impact analysis. The preliminary analysis models only the significant increase in potential emissions from a proposed new source (minor new source review permits may require that the entire facility be modeled), or the significant net emissions increase of a pollutant from a proposed modification (herein referred to as the significant impact analysis (SIA)). The results of the SIA determine if the applicant is required to perform the full impact analysis (FIA). A FIA is required for any pollutant for which a proposed source's estimated ambient pollutant concentration exceeds the significant ambient impact levels identified in Table 5.1 for Class I Areas and Table 5.2 for Class II Areas. It involves the estimation of background pollutant concentrations from existing sources and the proposed source. Both of these analyses may be performed with either a simple "screening model" or with a more complex "refined model." If a screening level model is used to perform the SIA or FIA, it is referred to as a screening analysis. If a refined level model is used, it is referred to as a refined analysis.

Table 5.1 Proposed Modeling Significance Levels for Class I Areas.
(These values should only be used if there is agreement between the MDEQ and the affected FLM that levels are appropriate for a given Class I Area.)

Pollutant	Averaging Periods for Class I Areas[a]				
	Annual ($\mu g/m^3$)	**24-hr ($\mu g/m^3$)**	**8-hr ($\mu g/m^3$)**	**3-hr ($\mu g/m^3$)**	**1-hr ($\mu g/m^3$)**
Sulfur Dioxide (SO_2)	0.1	0.2	b	1.0	b
Particulate Matter <10 μm (PM_{10})	0.2	0.3	b	b	b
Nitrogen Oxides (NOx)	0.1	b	b	b	b

a. All areas of Montana are designated as Class II except for those areas identified in Table 5.6 and shown in Figure 5.1. If a proposed source is located within 100 kilometers of a Class I area, an impact of 1 $\mu g/m^3$ on a 24-hr basis is significant. Also, note the Class I significance levels are included in parenthesis.

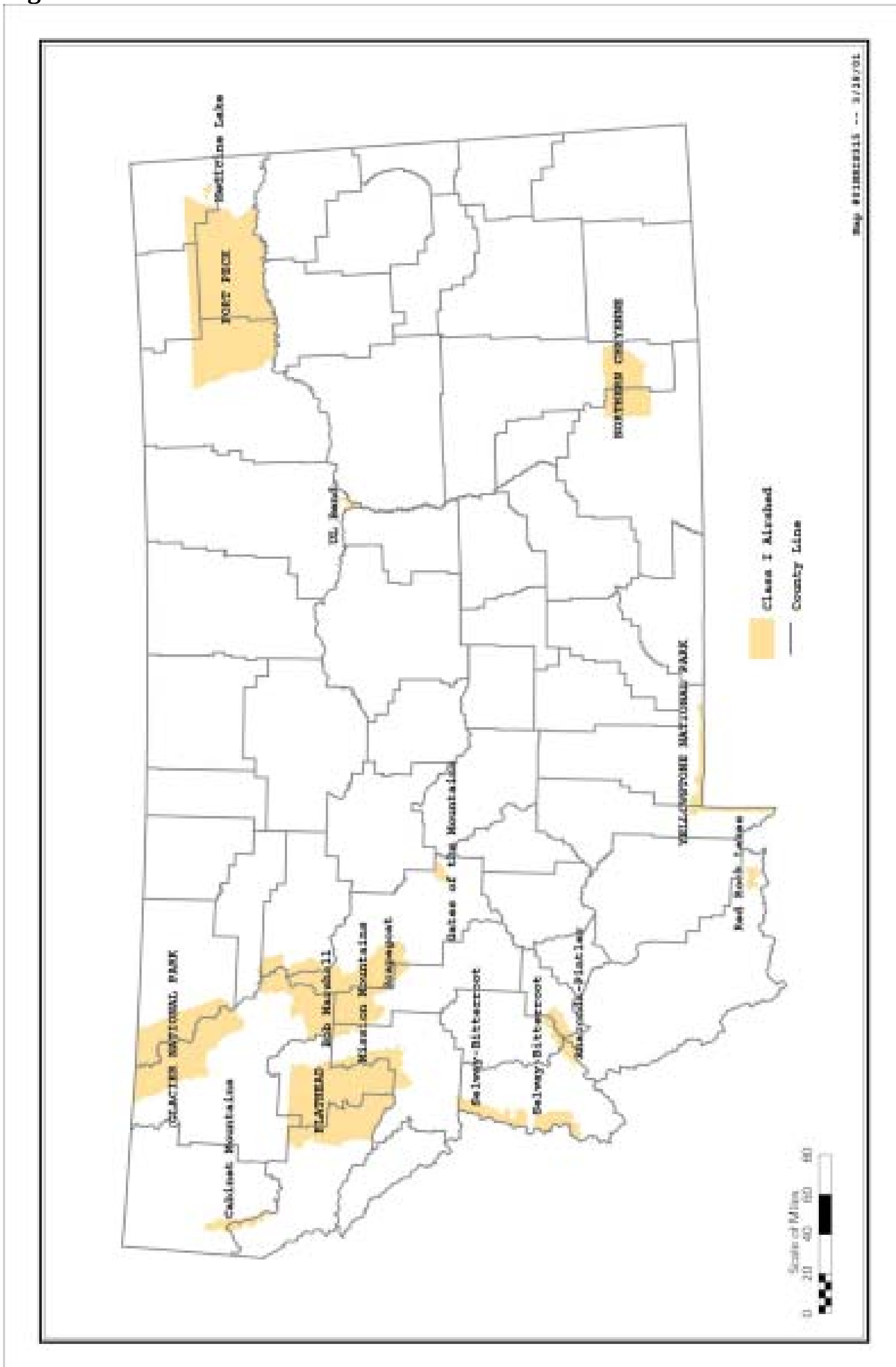
b. A modeling significance level has not been defined for this averaging period.

Table 5.2 Modeling Significance Levels for Class II Areas

Pollutant	Averaging Periods for Class II Areas[a]				
	Annual ($\mu g/m^3$)	**24-hr ($\mu g/m^3$)**	**8-hr ($\mu g/m^3$)**	**3-hr ($\mu g/m^3$)**	**1-hr ($\mu g/m^3$)**
Sulfur Dioxide (SO_2)	1	5	b	25	b
Total Suspended Particulate (TSP)	1	5	b	B	b
Particulate Matter <10 µm (PM_{10})	1	5	b	B	b
Nitrogen Oxides (NOx)	1	b	b	B	b
Carbon Monoxide (CO)	b	b	500	B	2,000
Ozone (O_3)	b	b	b	B	c

a. All areas of Montana are designated as Class II except for those areas identified in Table 5.6 and shown in Figure 5.1. If a proposed source is located within 100 kilometers of a Class I area, an impact of 1 $\mu g/m^3$ on a 24-hr basis is significant.
b. A modeling significance level has not been defined for this averaging period.
c. No significant ambient concentration has been established. Instead any net emissions increase of 100 tpy of VOC subject to PSD would be required to perform an ambient impact analysis.

Figure 5.1 Class I Areas in Montana



5.1 The Significant Impact Analysis

To perform, a SIA for a given pollutant and averaging period, the **highest** estimated concentration in ambient air is compared to the modeling significance levels in Table 5.2. Impacts from nearby and other background concentrations are **not** considered in the SIA. If the estimated concentration is below the applicable modeling significance level, no further analysis is required for the NAAQS, MAAQS, or PSD increments. If the impact exceeds the modeling significance levels, the source or modification has a significant ambient impact and a FIA is required (refer to Section 5.2).

For major sources and modifications subject to PSD review, the elements of the "additional impact analysis" in Class I and II areas must be addressed even if the estimated impacts are below the modeling significance levels (see Section 5.3.4 and 5).

For a new source, the requested emission rate, the operating rate, or the maximum design rate (after controls) is modeled, for more information refer to Section 6.2. If the requested emission or operating rate used in the modeling is less than the maximum design rate, it may become a permit condition.

The commercial, residential, and industrial growth analyses required for new sources and modifications subject to PSD rules does not need to be included in the SIA. The growth analysis is only required to be performed during the FIA.

For modifications/alterations to existing facilities not subject to PSD or NAA where approved facility-wide modeling is on file with MDEQ, only the facility-wide net emissions increase for the modification/alteration is modeled. For sources where facility-wide modeling has not been conducted for previous permits, all sources at the facility must be modeled for each applicable pollutant.

5.2 The Full Impact Analysis

A FIA is required for any pollutant for which the proposed source's estimated ambient impact concentration exceeds the significant impact levels identified in Table 5.2. This analysis expands the SIA to include impacts from:

- All other sources at the facility under review;
- "Nearby" (off-site) sources;
- "Nearby" sources which have received PSD permits but are not yet in operation;
- Proposed "nearby" PSD sources which have submitted complete PSD applications to a regulatory agency, but have not yet been issued permits;
- "Other background" sources; and
- Emissions from growth in residential, commercial, and industrial sources associated with, but not part of, the proposed source. The growth analysis applies only to major sources and modifications subject to PSD review.

The FIA may initially be performed using a screening model. If the screening analysis fails to show compliance with the standards, a refined analysis is required. If the refined analysis and additional modeling studies are not feasible or productive, various options to attain compliance can be considered, including:

- Emission limits;
- Operating schedule restrictions;
- Physical changes at the facility to improve dispersion characteristics;
- The use of fences or physical barriers to preclude public access from contiguous land owned or controlled by the operator (i.e., standards and increments only apply in "ambient air"); and
- Additional pollution control equipment.

Refer to Section 6.2.1 for guidance on selecting "nearby" and "other background" sources to include in the modeling. For the NAAQS demonstration, sources not included in the model (e.g., mobile sources, small stationary sources, and distant large sources) are accounted for by adding a background concentration from a representative air quality monitoring site.

Table 5.3 summarizes the goals of the FIA for different permit types. All new sources with a significant impact in ambient air must demonstrate compliance with the applicable NAAQS and MAAQS (Table 5.4**).** The determination of whether a source causes or contributes to a preexisting violation of the standard need only consider the impact of those new emitting units covered under the permit, permit alteration, or permit modification. For new sources and modifications subject to PSD rules additional requirements apply, such as the analysis to demonstrate compliance with the PSD increments, the additional impact analysis, and the comparison of impacts and existing air quality levels to the PSD monitoring de minimis concentrations to determine if monitoring is necessary (Table 5.4). When necessary, a permit condition shall require compliance with the MAAQS to be verified through the operation of ambient air monitors in the areas of suspected maximum concentration. On a case-by-case basis, the MDEQ may allow monitoring in lieu of modeling as a demonstration mechanism for MAAQS compliance. The requirements for determining if a facility should be required to conduct monitoring are covered under a separate guidance statement from MDEQ entitled *Monitoring Requirements (*Appendix F*).*

Table 5.3 Typical Goals of the Impact Analysis for Air Quality Permits[a]

Permit Type	Area Classification	Goals of Ambient Air Impact Analysis
New Sources or Modifications **Not Subject to PSD Rules**[b]	Attainment, Unclassifiable	NAAQS, MAAQS, Risk Assessments
New Sources or Modifications **Subject to PSD Rules**	Attainment, Unclassifiable	NAAQS, MAAQS, Class I and Class II PSD Increments
		Class II Additional Impacts Analysis on Visibility, Water**,** Soils, Vegetation, and Growth
		Class I Additional Impact Analysis on levels of acceptable change to AQRVs, including Visibility
		Pre and Post construction monitoring determination
Minor Sources or Minor Modifications	Nonattainment	NAAQS, MAAQS or Reasonable Further Progress (RFP) Analysis
Major Sources or Major Modifications	Nonattainment	NAAQS, MAAQS, or RFP Analysis
		Net Air Quality Benefit Analysis
		Visibility in Federal Class I Areas

a. Dispersion modeling may be required for other regulatory programs not shown in this table. Other possible modeling-related issues include compliance with ambient air standards in nearby states, risk assessments, etc.

b. Refer to ARM 17.8.801 and consult with MDEQ to determine is a new source or modification is subject to PSD review. In general, new minor sources, new synthetic minor sources, minor modifications at minor sources, and minor modifications at major sources are **not** subject to PSD review.

Table 5.4 National Ambient Air Quality Standards (NAAQS), Montana Ambient Air Quality Standards (MAAQS), and Monitoring De Minimis Concentrations

Pollutant	Avg. Period	Primary NAAQS	Secondary NAAQS	MAAQS	Monitoring De Minimis Concentrations[a]
Nitrogen Dioxide (NO_2)	1-hour	---------	---------	564 µg/m^3 0.30 ppm [b]	---------
	Annual	100 µg/m^3 0.053 ppm [c]	100 µg/m^3 0.053 ppm [c]	94 µg/m^3 0.05 ppm [c]	14 µg/m^3
Carbon Monoxide (CO)	1-hour	40,000 µg/m^3 35 ppm [b]	---------	26,450 µg/m^3 23 ppm [b]	---------
	8-hour	10,000µg/m^3 9 ppm [b]	---------	10,350 µg/m^3 9 ppm [b]	575 µg/m^3
Sulfur Dioxide (SO_2)	1-hour	---------	---------	1,300 µg/m^3 0.5 ppm [d]	---------
	3-hour	---------	1,300 µg/m^3 0.5 ppm [b]	--------	---------
	24-hour	365 µg/m^3 14 ppm [b]	---------	262 µg/m^3 0.10 ppm [b]	13 µg/m^3
	Annual	80 µg/m^3 0.30 ppm [c]	---------	52 µg/m^3 0.02 ppm [c]	---------
Ozone (O_3)	1-hour	235 µg/m^3	---------	196 µg/m^3 0.10 ppm [b]	100 tpy VOCs
	8-hour	157 µg/m^3 0.08 ppm	157 µg/m^3 0.08 ppm	---------	100 tpy VOCs
Particulate Matter < 10µm (PM_{10})	24-hour	150 µg/m^3 [e]	150 µg/m^3 [e]	150 µg/m^3 [e]	10 µg/m^3
	Annual	50 µg/m^3 [f]	50 µg/m^3 [f]	50 µg/m^3 [f]	---------
Particulate Matter < 2.5 µm ($PM_{2.5}$) (not promulgated)	24-hour	65 µg/m^3	65 µg/m^3	---------	---------
	Annual	15 µg/m^3	15 µg/m^3	---------	---------
Lead (Pb)	Calendar Quarter	1.5 µg/m^3	1.5 µg/m^3	1.5 µg/m^3 [c]	0.1 µg/m^3
	Monthly	---------	---------	1.5 µg/m^3	---------
Mercury (Hg)	24-hour	---------	---------	---------	0.25 µg/m^3
Beryllium (Be)	24-hour	---------	---------	---------	0.001 µg/m^3
Fluorides	24-hour	--------	---------	---------	0.25 µg/m^3
Vinyl Chloride	24-hour	---------	---------	---------	15 µg/m^3
Total Reduced Sulfur	1-hour	---------	---------	---------	10 µg/m^3
Hydrogen Sulfide (H_2S)	1-hour	---------	---------	700 µg/m^3 0.05 ppm [b]	0.2 µg/m^3
Reduced Sulfur Compounds	1-hour	---------	---------	---------	10 µg/m^3
Fluoride in Forage	Monthly	---------	---------	50 µg/gm	---------
	Grazing Season	---------	---------	35 µg/gm	---------

Table 5.2.1 National Ambient Air Quality Standards (NAAQS), Montana Ambient Air Quality Standards (MAAQS), and Significant Monitoring Concentrations (Continued)

Pollutant	Avg. Period	Primary NAAQS	Secondary NAAQS	MAAQS	Monitoring De Minimis Concentrations[a]
Settable Particulate	30-day	---------	---------	10 gm/m^2	---------
Visibility	Annual	---------	---------	3 x 10^{-5}/m	---------

a. The monitoring de minimis concentrations apply only to new sources and modifications subject to PSD review. It determines if premonitoring will be required.
b. Not to be exceeded more than once per year.
c. Not to be exceeded.
d. Not to be exceeded more than eighteen times in twelve consecutive months.
e. The standard is the average of the expected exceedance for three consecutive years. The standard is attained when the expected number of days per calendar year with maximum 24-hor averages above the standard is equal to or less than one. For modeling purposes, it is calculated as the highest 6th high 24-hr average concentration for a five-year period.
f. The standard is an average of the expected means for three consecutive years. For modeling purposes, it is calculated as the highest five-year average for the annual value.

5.3 Additional Compliance Goals for New Sources and Modifications Subject to PSD Rules

This section is intended for new sources and modifications subject to PSD rules that are located in attainment or unclassified areas of Montana. Sources located in NAAs should initially read Section 5.3.6.

5.3.1 Pre and Post Construction Monitoring

MDEQ monitoring staff should be contacted to discuss the need to conduct preconstruction monitoring. The modeling report submitted with the permit application should address the need for post-construction monitoring.

If monitoring is proposed or required, a monitoring plan consistent with recent EPA and MDEQ monitoring guidance (e.g., policy) should be submitted for approval.

5.3.1.1 Preconstruction Monitoring

If preconstuction monitoring is required, the timeline for submitting a PSD application could be affected by the requirement to collect ambient data. For instance, if the collection of site-specific meteorological data and /or ambient pollutant measurements is required, a full year of data must typically be collected and approved by MDEQ before the permit application can be processed and ruled as complete.

If the proposed emission rate from a new source or the net emissions increase from a modification is significant for a given pollutant, as defined by ARM 17.8.801(24), the estimated impact from the new source or modification should be compared to Table 5.4 (significant monitoring concentration) to determine if monitoring will be required.

It is important to realize that ARM 17.8.818(7)(a) explicitly specifies the concentration that triggers preconstruction monitoring.

5.3.1.2 Post Construction Monitoring

In accordance with ARM 17.8.822 (8), the decision to require post-construction monitoring is discretionary as suggested by federal regulations. Refer to Appendix F for requirements to determine if a facility may be required to conduct monitoring.

5.3.2 Regulated, Non-Criteria Pollutants

For regulated, non-criteria pollutants in Table 5.4, a separate air quality analysis must be submitted if the applicant proposes to emit the pollutant in a significant amount from a new source or proposes to cause a significant net emissions increase from a modification. Estimated impacts from regulated non-criteria pollutants should be presented and compared to the significant monitoring concentrations in Table 5.4 to determine if post monitoring is required. For those pollutants not identified in Table 5.4, the applicant shall conduct the analysis and monitoring as MDEQ determines is necessary (ARM 17.8.822(4)).

5.3.3 PSD Increment Consumption/Expansion

All changes in emissions and related parameters[2] after the "minor source baseline date" may affect PSD increment consumption or expansion.[3] These changes include both stationary and mobile sources. In addition, modifications at major sources after the major source baseline date also may affect increment consumption. Refer to EPA guidance (e.g., EPA, 1990; EPA, 1993b) for procedures. The air quality analysis for all new or modified sources subject to PSD rules must address PSD increment consumption. Table 5.5 identifies the PSD increments for all Class areas and averaging periods.

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[2] The creditable increase of an existing stack height or the application of any other creditable dispersion technique may effect increment consumption or expansion in the same manner as an actual emissions increase or decrease. That is, the effects that a change in effective stack height would have on ground level pollutant concentrations should be factored into the increment analysis (EPA, 1990).

[3] A PSD increment is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant. The baseline concentration is defined for each pollutant and, in general, is the ambient concentration existing at the time the first complete PSD permit application affecting the area is submitted (EPA, 1990).

Table 5.5 PSD Increments for Class I, Class II, and Class III Areas

Pollutant	Averaging Period	Class I ($\mu g/m^3$)	Class II ($\mu g/m^3$)	Class III[c] ($\mu g/m^3$)
NO_2	Annual[a]	2.5	25	50
SO_2	3-hr[b]	25	512	700
	24-hr[b]	5	91	182
	Annual[a]	2	20	40
PM_{10}	24-hr[b]	8	30	60
	Annual[a]	4	17	34

[a] Never to be exceeded
[b] Not to be exceeded more than once per year
[c] There are currently no designated Class III Areas in the United States

5.3.4 Additional Impact Analysis for Class I Areas

The additional impact analysis in Class I areas addresses changes to Air Quality Related Values (AQRVs), including visibility. The goal of the Class I impact analysis is to determine if the levels of change to AQRVs, including visibility, are acceptable for a given Class I area. Refer to ARM 17.8.825 for the regulatory requirements. A permit application can be denied if a proposed source would impair visibility in a Class I area.

The additional impact analysis should be based on the appropriate models and procedures recommended in federal guidance documents and publications (e.g., FLAG, 2000; EPA 1998b, and Bunyak, 1993). The modeling approach may be unique for each Class I area depending on the FLM's assessment of whether or not an adverse impact would occur. The assessment is based on the sensitivity of the AQRVs at the particular FLM area under consideration. Consequently, the MDEQ recommends that the Class I modeling approach be presented in a written modeling protocol with the Class II modeling approach.

New and modified sources are required to determine if their plumes will impair visibility in any Class I area. This may include an analysis of source specific haze (e.g., regional haze analysis).

As a first step, permit applicants should contact the MDMB to determine which Class I areas to include in the analysis. The MDMB will help initiate the Class I modeling process by contacting the appropriate FLM(s) to obtain Class I significance levels and other information regarding levels of acceptable change to AQRVs, including visibility. It should be emphasized that the initial modeling-related contact is distinct from the permit-processing step where the permit application is forwarded to appropriate FLMs as part of the completeness determination and permit review process.

In general, a complete permit application should include a thorough AQRV analysis, including analysis of the impacts on visibility, soils, water, odor, flora, and fauna, that would occur as a result of the source or modification, in conjunction with all other emission sources affecting an area. Also, an air quality impact analysis is required to predict the effects of general commercial, residential, industrial, and other growth associated with the source or modification.

5.3.4.1 Class I Visibility Analysis

The focus of this analysis is on assessing the visibility impacts in Class I areas. A permit can be denied if potentially adverse visibility effects are estimated to occur in a Class I area.

Visibility requirements for new sources and modifications subject to PSD rules are found in Subchapter 8, PSD (ARM 17.8.824 and 825) and Subchapter 11 Visibility Impact Assessment (ARM 17.8.1101 – 1111).

5.3.4.2 Class I Air Quality Related Values Analysis

The primary federal guidance document is the "Federal Land Manager's Air Quality Related Values Workgroup (FLAG):Phase I Report" (Flag, 2000).

5.3.5 Additional Impact Analysis in Class II Areas

The additional impact analysis in Class II areas includes a soils and vegetation analysis, a water analysis, and a visibility impairment analysis. All of Montana is Class II except for those areas designated as Class I areas in Figure 5.1 and Table 5.6. A growth analysis will be required only if a full impact analysis is triggered. The soils and vegetation analysis is intended to provide information about the potential for adverse impacts on soils and vegetation. The visibility analysis is intended to address Class II visibility impacts within the impact area of the source.

In Montana, the focus of the Class II visibility analysis is on a specific set of "scenic and/or important views." These may be provided by the MDMB. The environmental impact analysis associated with the best available control technology (BACT) determination is distinct from the air quality impact analysis process described here. Nevertheless, if the additional impact analysis suggests there will be adverse impacts to soils, vegetation, or visibility, the information may be used in the BACT review process.

Table 5.6 Class I Areas in Montana

Bob Marshall Wilderness Area
Anaconda Pintler Wilderness Area
Cabinet Mountains Wilderness Area
Gates of the Mountain Wilderness Area
Glacier National Park
Medicine Lake Wilderness Area
Mission Mountains Wilderness Area
Red Rock Lakes Wilderness Area
Scapegoat Wilderness Area
Selway-Bitteroot Wilderness Area
UL Bend Wilderness Area
Yellowstone National Park
Northern Cheyenne Reservation
Flathead Reservation
Fort Peck Reservation

5.3.6 The Impact Analysis for Minor and Major Sources/Modification in Classified Nonattainment Areas

Sources located in or impacting classified nonattainment areas are usually subject to modeling requirements. Refer to Section 1.4 to determine if modeling is required. If a classified nonatttainment area has shown no violations within the last three years through monitoring then the modeling approach for minor sources is the same as that for sources located in attainment or unclassified areas. **Since most classified nonattainment areas in Montana are in monitored attainment, nonattainment area Reasonable Further Progress (RFP) analyses are seldom a requirement to obtain air quality permits in Montana.**

To explain RFP guidance for permits, it's necessary to provide some background information from the SIP perspective. RFP/ Milestone demonstrations are required as SIP submissions to EPA for some NAAs. As such, an NAA-wide RFP/ Milestone analysis is performed. These reports are prepared and submitted to EPA by the MDEQ. Permit-related RFP analyses are not submitted to EPA unless it's part of the analysis for a major source or modification subject to New Source Review.

Once a classified nonattainment area is in monitored attainment, EPA may not require the MDEQ to submit a rigorous NAA-wide RFP/ Milestone analysis. Nevertheless, EPA may still require some type of less rigorous analysis. The MDEQ interprets this to mean that a rigorous RFP analysis is **not** required to obtain a stationary source permit if the nonattainment area is already in monitored attainment. From a permit modeling perspective, the following RFP guidance applies:

a. If impacts due to emissions from a new source or modification would prevent a nonattainment area from coming into compliance by the applicable date in the Clean Air Act or in the SIP, then the source impairs RFP.

b. If RFP toward attainment of the NAAQS would be impaired, the permit will not be issued unless additional controls, limitations, or mitigating measures are adopted to correct the modeled violation.

c. In NAAs where the monitoring network data show the area to be in attainment with the NAAQS, the concept of an RFP analysis is meaningless. Thus, an RFP analysis is not required for NAAs that are in monitored attainment. Of course, other NAA permit requirements (e.g., the net air quality benefit analysis and emissions offsets requirements from major sources/modifications) still apply.

d. If RFP modeling is required, the modeling procedures for major and minor sources are decided on a case-by-case basis. The procedures can vary based on the size of the source, the dispersion characteristics, the location, and the other factors that are important in a given NAA.

6.0 Basic Model Input Data Requirements

Technical options to be selected for regulatory modeling are outlined in the GAQM. Any selection of a technical option that deviates from regulatory guidelines is subject to prior approval by MDEQ.

The internal source codes for regulatory models should not be modified, in a manner that would change the basic algorithms used by the model to calculate ground-level concentrations, without MDEQ review and comment. Minor changes unrelated to model algorithms, such as re-dimensioning of source or receptor arrays do not require MDEQ coordination.

Document and submit substantial preprocessor/postprocessor programs or subroutines to the MDEQ. For example, a program used to calculate downwash parameters for entry into ISC model is a substantial preprocessor program. An example of a substantial postprocessor program would be one that is used to count the number of exceedances at each receptor for a specific averaging period.

6.1 Urban Versus Rural Dispersion Options

The classification of the land use in the vicinity of air pollution sources is necessary because dispersion rates differ between urban and rural areas. In general, urban areas have greater rates of dispersion because of increased turbulent mixing and buoyancy-induced mixing. The turbulent mixing results from the combination of greater surface roughness caused by more buildings and structures, and greater amounts of heat released from concrete and similar surfaces.

EPA guidance provides two procedures to determine if an area is predominantly urban or rural. One procedure is based on land-use typing while the other is based on population density. Both procedures require an evaluation of the characteristics within a 3 km radius from a source. The land-use typing method is based on the work of A. Auer (GAQM Section 8.2.8). It is the preferred method because it is more directly related to the surface characteristics of the evaluated area that affect dispersion rates. In Montana, this method will result in the selection of rural dispersion.

6.2 Emissions Inventory for New Sources and Modifications

The emissions estimates used for modeling should be consistent with EPA recommendations in Table 9.2 of the GAQM and other applicable EPA guidance. Refer to EPA guidance if the model is to be used to establish emission limits for a source.

For new sources or modifications subject to PSD rules, various operating loads for the new sources or modification should be modeled when appropriate.

If a FIA is required, it is necessary to include other existing sources at the facility. Refer to the GAQM to determine what type of emissions estimates to use for existing sources.

Permit conditions may be proposed based on the information used in the modeling. For example, if the operating level is limited or if the modeling uses a restricted operating schedule (i.e., less than 24 hours per day), the operating conditions may become permit conditions.

6.2.1 Guidance for Selecting Nearby Source and Other Background Concentrations

MDEQ does not recommend a specific objective procedure for determining which sources should be classified as "nearby" and which should be classified as "other background sources." All surrounding sources that will "significantly" (as defined in the EPA's *New Source Review Workshop Manual*) contribute to the impact of a new or major modification to a source must be included in the modeling analysis. All sources greater than 25 tons per year which are located within 50 km of the subject source's area of significant impact should be included in the analysis.

The procedure used to select sources should use professional judgement and be determined on a case-by-case basis after considering local conditions such as topography, dispersion characteristics, availability of ambient monitoring data, existing air quality, and other relevant factors. The procedure should include an examination of the modeling results to ensure that all sources that should have been included were included.

The following approach is generally acceptable:

> For new sources and modifications, obtain from the MDEQ an emission inventory of stationary sources within 50 km of the significant impact area of the new source or modification under review. Identify "nearby" sources to explicitly model. Select additional "background" sources as appropriate to account for impacts not reflected in the background concentrations. Sources beyond 50 km may need to be included if long-range transport modeling is being performed for a Class I area.

6.2.2 Emission Inventory for Nearby and Other Background Sources

The emissions estimated used in modeling nearby and other background sources should be consistent with EPA recommendations in Table 9.2 of the GAQM and other applicable EPA guidance.

In this document, the terms "**nearby sources**" and "**other background sources**" refer to existing sources at the facility under review and existing off-site sources. It does not include the new source or modification under permit review. Nearby and other background sources must be considered if a full impact analysis is required.

EPA requires that, at a minimum, all “nearby” sources must be explicitly modeled as part of the NAAQS analysis. “Other background” sources usually are accounted for by using an appropriate background concentration (i.e., § 9.2.2 of the GAQM) or, if suitable ambient background concentration is not available, by application of a model using inventory recommendations from Table 9.2 of the GAQM.

Determination of the nearby sources accounted for by the background concentration can be rather subjective. Consequently, the modeler should review the location and collection date of the background data with respect to nearby sources to determine how it should be incorporated into the overall modeling procedure. Unless site specific or more appropriate background values are available, Table 6.1 identifies background values to be added to modeling concentrations where all significant local sources have been included.

Table 6.1 Background Pollutant Values for Modeling Demonstrations

Pollutant	Averaging Period	Background* ($\mu g/m^3$)
PM_{10}	Annual	8
	24-hour	30
SO_2	Annual	3
	24-hour	11
	3-hour	26
	1-hour (19th)	35
CO	8-hour	1150
	1-hour	1725
NO_2	Annual	6
	1-hour	75

*Data developed from SALEM site operated during 1980 and 1981 by the Montana Power Company at a site located about 10 miles east-northeast of Great Falls, Montana. Assumes that all significant sources local sources are included in the modeled scenario.

The use of background concentrations for PSD increment modeling is not recommended due to the difficulty in determining which portion of the background is from increment-consuming sources.

6.3 Receptor Grid Design

The creation of receptor grids varies with the goals of each modeling study and requires case-by-case professional judgement. Factors such as the source’s release height; proximity of emission points, fugitive areas, and other sources to the property line; the location of the nearest residents and other sensitive receptors and monitors; topography, density of nearby sources, meteorology, and requirements of the selected model should be considered before selecting receptor locations and spacing. MDEQ does not place any limits on the number or spacing of receptors for the purpose of coarse grid modeling but the grid must be able to define the areas of highest possible impact. After the hotspots have been located, the user is required to remodel these areas with a receptor grid tight enough to ensure the maximum point of impact has been identified. In general, Cartesian receptor grids are preferred over Polar receptor grids because the receptor spacing for Polar grids becomes too wide as distance increases from the source. Polar receptor grids should only be used for coarse grid and single stack modeling.

It is the applicant's responsibility to demonstrate that the final receptor network is sufficiently dense to identify the maximum estimated pollutant concentrations for each averaging period. This applies to modeling performed to demonstrate compliance with the PSD increments, NAAQS, and MAAQS. While source specific issues such as expected plume rise and topography must be considered in developing receptor grids, the following recommendations provide a good starting point for developing an acceptable receptor grid:

a. for distances up to 1 km – 100 m receptor spacing;
b. from 1 to 3 km – 250 m spacing;
c. from 3 to 10 km – 500 m spacing;
d. beyond 10 km – grid with 1 km spacing;
e. along fence lines – 50 to 100 m spacing;
f. if no fence or boundary – 50 m spacing near the source under review;
g. discrete receptors for sensitive nearby sites (e.g., residences, schools) unless the grid is sufficient to quantify impacts;
h. if the modeled maximum concentration from the facility under review (or the maximum concentration in a full impact analysis) occurs in a "coarse" receptor grid, additional modeling should be performed with a fine grid to find the maximum concentration; and
i. additional fine receptor grids or discrete receptors may be necessary in complex or sensitive areas to clearly define the area of maximum impact.

Receptors may be omitted from the property of the facility under review, provided it is inaccessible to the general public. If there is not a physical barrier (e.g., fence, wall etc.) receptors should be located in the property of the applicant. MDEQ and/or EPA approval is necessary if the applicant wants to use a physical barrier such as a canyon, river, tailings pile, or other physical features as the ambient air boundary. If a physical barrier is approved by the MDEQ to preclude public access, frequent posting is usually necessary along with routine security patrols; in addition, points of public access in the posted area (e.g., roads trails etc.) must be fenced or gated. Refer to EPA memos on the subject (e.g., EPA, 1984; EPA, 1986; EPA, 1987a; EPA, 1987b; and EPA, 1989).

6.3.1 Elevation Data for Sources and Receptors

Enter all receptor locations into dispersion models in Universal Transverse Mercator (UTM) coordinates in order to be consistent with on- and off- property emission point locations, § 4.3 of the permit application, emission inventory databases, and other reference material, such as U.S. Geological Survey (USGS) topographic maps.

Provide the datum used for the UTM coordinates. Applicable UTM zones in Montana are 11, 12, and 13. Do not use coordinate systems based on plant coordinates or other applicant-developed coordinate systems.

6.3.2 Terrain Elevation Data for Sources and Receptors

Simple terrain (terrain with elevations below the level of pollutant release) and complex terrain (terrain elevations above the level of pollutant release) must be addressed in all modeling analyses if terrain within the vicinity of the source is expected to have an effect on the pollutant dispersion. Modeling analyses that involve both simple and complex terrain must conform to the EPA intermediate terrain policy. Terrain elevations for sources and receptors should be used as appropriate (refer to EPA guidance). Also, discuss the source terrain data in the modeling report.

The elevations for receptors used to develop the receptor grids should be extracted from the same database to avoid discontinuities. If elevations are extracted from different sources of data, the grid should be reviewed with a computer visualization application to check for significant discontinuities that could affect the modeling results. For fine grid analyses with receptor spacing of 100 meters are less, USGS 7.5-minute series quadrangles (1:24,000) should be used. The USGS 1-degree by 1-degree block (1:250,000) maps may be used for coarse grid analyses. Although it may be necessary to pick elevations for discrete receptors in nearby complex terrain using better resolution data. For nearby receptors, the 7.5-minute series quadrangles are preferred.

Recently, USGS Digital Elevation model (DEM) data has become available. A DEM is a digital file consisting of terrain elevations for ground positions at regularly spaced intervals. The USGS distributes two digital elevation data products in the standard DEM tape format that could be used in state and federal air dispersion modeling demonstrations in Montana: large scale and small scale.

Large Scale: USGS 7.5-minute DEMs that correspond to standard USGS 1:24,000-scale, 7.5 by 7.5-minute quadrangles.

- The data are produced in 7.5 by 7.5-minute blocks either from map contour overlays that have been digitized or from automated or manual scanning of photographs usually taken at an average height of 40,000 feet (1:80,000-scale).

- The data are processed to produce a DEM with a 30-meter sampling interval. Each 7.5-minute unit of DEM coverage consists of a regular array of elevations referenced horizontally in the UTM projection coordinate system. These horizontally referenced data may be in the North American Datum (NAD) 27 or NAD83 for the continental U.S. Elevation units are in meters or feet relative to the National Geodetic Vertical Datum of 1929 (NGVD29).

Small Scale: Defense Mapping Agency-produced 1-degree DEMs that correspond in coverage to 1-degree by 1-degree blocks (one-half of standard 1:250,000-scale, 1-degree by 2-degree quadrangles).

- The data are produced by interpolating elevations at intervals of 3 arc-seconds from contours, ridge lines, and drains digitized from 1:250,000-scale topographic maps. Three seconds of arc represents approximately 90 meters in the north-south axis and a variable dimension (approximately 90 meters at the equator to 60 meters at 50 degrees latitude) in the east-west axis due to convergence of the meridians. The area of each map is divided into an east half and a west half to accommodate the large volume of data required to cover the 1-degree by 2-degree topographic map.

- The 1-degree DEM consists of a regular array of elevations referenced horizontally on the geographic coordinate system of the World Geodetic System (WGS) 72, which was converted to WGS84. Elevations are in meters relative to NGVD29 in the continental United States.

The 7.5-minute and 1-degree DEM data files are identical in logical data structure but differ in sampling interval, geographic reference system, areas covered, and accuracy of data. USGS 7.5-minute DEM data are available for selected quadrangles in the United States; 1-degree DEM data are available for most of the United States.

DEM data can significantly reduce the amount of work necessary to create receptor grids. However, the resolution of USGS 1:250,000 DEM data may not be used for refined modeling because it is possible for entire ridges and small terrain features to be absent from the 1:250,000 scale. The 7.5-minute USGS DEM data will be acceptable for refined modeling when it becomes available.

Keep in mind that the UTM is just one of many map projections used to represent locations on a flat surface. Also, be aware that there are several horizontal data coordinate systems or datum (NAD27, WGS72, NAD83, and WGS84) that are used to represent locations on the earth's surface in geographic coordinates (latitude and longitude). Spatial data (Global Positioning System output, digitized maps, DEMs, etc.) used to obtain receptor, building, and source locations can be in any one of these systems.

When representing receptor, building, and source locations in UTM coordinates, make certain that all of the coordinates originated in, or are converted to, the same horizontal datum. There are many free and commercial computer programs available to convert from geographic coordinates to UTM coordinates; however, not all of these programs are appropriate for conversion between horizontal data coordinate systems. For example, programs that do not prompt the user for a specific horizontal datum are not appropriate.

6.4 Meteorological Data

The meteorological condition under which pollutants are released into the atmosphere is the controlling determinant of dispersion efficiency in the air quality models. In most dispersion modeling analyses, the user should attempt to define the worst-case scenario for pollutant dispersion in order to predict the highest possible model predicted concentration.

6.4.1 Screening Meteorological Data

Screening models use a worst-case meteorological data set. Screening meteorology instead of actual meteorology may be used to show compliance with standards and increments. For estimating maximum one hour impacts in simple terrain, the following meteorological conditions identified in Table 6.2 must be included.

Table 6.2 Screening Meteorological Conditions

Stability	**Wind Speed (m/s)**												
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	8.0	10.0	15.0	20.0
A	*	*	*	*	*								
B	*	*	*	*	*	*	*	*	*				
C	*	*	*	*	*	*	*	*	*	*	*		
D	*	*	*	*	*	*	*	*	*	*	*	*	*
E	*	*	*	*	*	*	*	*	*				
F	*	*	*	*	*	*	*						

The conditions identified in Table 6.2 are the same meteorological categories used in EPA's SCREEN3 model (EPA, 1995). A minimum of 36 wind directions must be used (at 10-degree increments). However, one-degree increments are preferred.

For screening meteorology, a worst case mixing height needs to be used. For neutral and unstable meteorological conditions ("A" - "D") this should be set at 1 meter above the predicted plume height for "A" stability and a wind speed of 1 meter/second. This mixing height can be obtained from the EPA SCREEN3 model. However the mixing height should not be less than 320 meters (to be consistent with the SCREEN3) model. For stable conditions ("E" and "F"), a mixing height of 500 meters should be used. Applicants may request a copy of this screening meteorological data file from MDEQ.

MDEQ has also constructed a worst-case data screening set using meteorological data assumptions from the SCREEN3 model for use with the ISCST3 model (for modeling multiple, more complex sources). MDEQ will allow sources to use the worst-case meteorological data in a refined screening model for NAAQS, and PSD increment modeling analyses, only if representative actual meteorological data set is not available. Only 1-hour concentrations can be calculated using the worst-case meteorological data set. For other averaging periods, impacts must be calculated by applying the time-scaled conversion factors, listed in Table 6.3, to the model predicted 1-hour concentration.

MDEQ will allow minor sources to use worst-case meteorological data in a refined screening model for NAAQS and PSD increment modeling analyses, only if a representative actual meteorological data set is not available and prior approval is obtained from MDEQ.

6.4.2 Actual Meteorological Data

Ideally, a modeling analysis should attempt to simulate dispersion under conditions that would actually occur at a facility. New or major modifications to PSD sources may be required to collect at least one year of continuous on-site meteorological data for use in the modeling analysis. Meteorological data used in a refined modeling analysis should be approved by MDEQ prior to conducting the modeling analysis. To prevent unnecessary delays during the permit review process, applicants are strongly encouraged to submit meteorological and ambient air monitoring data to MDEQ before submitting the modeling analysis. This can be done prior to the modeling submittal or as part of the modeling protocol review.

MDEQ requires that 1-year of site-specific data or 5 years of representative National Weather Service (NWS) data be used. If more than 1 year of site-specific data exist, multiple years (up to five years) should be used. If "representative" data are not available, it may be necessary to collect at least 1 year of site specific data. To demonstrate that the data is representative, the applicant may provide an analysis comparing the physiographic and meteorological parameters of the data site using the minimum requirements outlined in Appendix E. Any source intending to collect site-specific data should contact the MDEQ prior to establishing a monitoring program in order to ensure that EPA and MDEQ requirements for ambient air monitoring projects are met.

When deciding if on-site data must be collected, MDEQ modeling staff will consider the following:

a. existing air quality in the area;
b. proposed emission levels from the new source or modification;
c. dispersion characteristics of the source under review;
d. meteorological and dispersion issues associated with complex terrain;
e. distance to the nearest Class I area (for new sources and modifications subject to PSD rules);
f. the likelihood that the source will have an adverse impact on ambient air quality;
g. whether or not the source is subject to PSD rules (monitoring is more likely to be required for major new sources or major modifications subject to PSD rules than for minor sources); and
h. other relevant factors.

Often minor sources and modifications to major sources are not required to collect site-specific data. Nevertheless, it may be required if air quality standards in the affected area are threatened and/or if the source's impact is high enough to jeopardize applicable standards.

Actual meteorological data is necessary if the source cannot show compliance with ambient standards or PSD increments using screening meteorology. Sources may elect to voluntarily reduce emissions to show compliance through modeling with screening meteorology rather than choosing to collect on-site meteorological data.

For PSD permit applications, some unprocessed meteorological data are available on the EPA's SCRAM Internet page. The SCRAM address is http://www.epa.gov/scram001.
Data not available on the SCRAM may be obtained from the National Climatic Data Center. Process the data using the PCRAMMET (EPA, 1998a) program. In addition, on-site meteorological data may be used if appropriate and if obtained in accordance with EPA guidance (EPA, 1987c). Certain complex terrain models, such as CTDMPLUS, require on-site meteorological data.

For the commonly used ISC models, the MDEQ can provide guidance on meteorological data processing and input options including mixing height, temperature, and anemometer height.

6.5 Time Averaging Periods

Applicants preparing regulatory analyses are required to address all applicable NAAQS, MAAQS, and PSD increment averaging periods that apply to the pollutant being modeled. Some models such as SCREEN3, however, will only calculate 1-hour average concentrations (24-hour average if addressing complex terrain issues). EPA has established time-scaled conversion factors to convert 1-hour averages to other averaging periods (EPA, 1992). The time-scaled factors appear in Table 6.3.

Table 6.3 Averaging Time Conversion Factors for Screening Meteorology

Averaging Period	SCREEN3 Conversion Factor
3-Hour	0.90 (±0.1)
8-Hour	0.70 (±0.2)
24-Hour	0.40 (±0.2)
Annual	0.08 (±0.02)
Values in the parenthesis may increase - if downwash or terrain is a problem or if the emission height is very low or may Decrease - if the stack is relatively tall and there are no terrain or downwash problems	

6.6 Building Wake Effects (Downwash)

Airflow over and around buildings and other structures may restrict the dispersion of a pollutant source. A modeling analysis of point sources with stack heights that are less than good engineering practice (GEP) stack height should consider the impacts associated with building wake effects (also referred to as downwash). Building wake effects are not considered for area or volume sources.

As defined by the *Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations)* (EPA, 1985), GEP height is calculated as:

$$GEP = H_b + 1.5L,$$

Where :

H_b = the building height; and

L = the lesser of the building height or the greatest crosswind distance of the building (also known as maximum projected width).

This formula defines the stack height above which building wake effects on the stack gas exhaust may be considered insignificant.

Region of Influence: A building or structure is considered sufficiently close to a stack to cause wake effects when the minimum distance between the stack and the building is less than or equal to five times the lesser of the height or projected width of the building (5L). This distance is commonly referred to as the building's *region of influence*. If the source is located near more than one building, assess each building and stack configuration separately.

Apparent Width: If a building's projected width is used to determine 5L, determine the apparent width of the building. The *apparent width* is the width as seen from the source looking towards either the wind direction or the direction of interest. For example, for short-term modeling, the ISCST model requires the apparent building widths (and also heights) for every 10 degrees of azimuth around each source.

To account for downwash, the SCREEN model requires the entry of a building or structure height and the respective maximum and minimum horizontal dimensions. Generally, include the building with dimensions that result in the highest GEP stack height for that source, to evaluate the greatest downwash effects.

Be aware that when screening tanks, the tank diameter should not be used. The SCREEN model uses the square root of the sum of the individual squares of both the width and length for a structure in order to calculate the projected width. Because most tanks are round, the projected width is constant for all flow vectors. However, using the actual tank diameter for both width and length will result in a projected width that is too large. Therefore, when screening tanks, a modeler should divide the diameter of the tank by the square root of 2.

The ISC model also contains algorithms for determining the impact of downwash on ambient concentration; and uses them to determine the refined concentration estimates. Methods and procedures to determine the appropriate entries to account for downwash are discussed in the EPA's GEP guidance document (EPA, 1985).

Due to the complexity of GEP guidance, the EPA has developed a computer program for calculating downwash parameters for use with the ISC models. This program is called the Building Profile Input Program (BPIP) (EPA, 1993a), and it is available from the EPA SCRAM Internet page. Use the most current version of the BPIP or a proprietary version of BPIP to determine downwash parameters for use with the ISC models.

6.7 Cavity Calculations

Sources with release points located near the facility property boundary with stack heights less than GEP are required to submit a cavity region analysis with the modeling submittal. Cavity concentrations are considered to be a valid ground level concentration when addressing NAAQS and PSD increment consumption, if the length of the cavity extends beyond a restricted property boundary. The SCREEN model predicts cavity concentrations.

EPA has proposed changes to the ISC model to incorporate the Plume Rise Model Enhancements (PRIME) model; the integrated model is called ISC-PRIME, to the GAQM as a preferred model. This model can compute concentrations in a cavity region. ISC-PRIME should be used to resolve any cavity issues resulting from the use of the ISC model.

6.8 Variable Emission Rate Option

When sources can operate only during specified hours, the variable emission rate option may be used to restrict the modeling analysis to the hours of operation only. If this option is used, permit conditions may restrict the operation of the permitted source to the time period modeled.

The variable emission rate option may also be used to simulate other operating scenarios as necessary to design permit conditions.

6.9 Concentration Maps

Include gridded concentration maps demonstrating that the maximum predicted concentration has been found in the air quality analysis. Use isopleths rather than actual concentration plots only if the presentation shows that concentrations are clearly decreasing away from the sources being modeled and comparisons with de minimis or significance levels are not an issue. When isopleths are used, the maximum off-property concentration must be clearly identified in the report and modeling output files.

7.0 Modeling Technical Review Process

The review is done to ensure that the modeling output is technically representative and sufficient and that any deviations from guidance do not significantly affect the compliance demonstration. As the review progresses, the MDMB provides the status of the review as appropriate to the applicant's modeler and the permit engineer.

To assist the MDMB, follow reporting requirements and provide clear documentation of how the modeling was done and what assumptions were made. In addition, include in the air quality analysis any calculations that were necessary to develop the input data required to run the selected model.

If the MDMB staff finds errors or discrepancies, they will attempt to evaluate the submittal and determine whether the errors or discrepancies would cause a significant change in the magnitude or location of the predicted concentrations. This evaluation may determine whether the submittal would be technically representative and usable by the staff to determine if the permit should be issued. The MDMB will work closely with the permit engineer and the applicant's modeler to resolve omissions, unclear documentation, or other problems.

If the MDMB cannot resolve a modeling deficiency, then the modeling submittal is not accepted, and recommended corrective actions or deficiency items are forwarded to the permit engineer. The permit engineer will subsequently issue an incompleteness letter to resolve any modeling deficiencies or other deficiencies identified during the review of the permit application.

In order to prevent any delays in the review of any the regulatory modeling analyses submitted to MDEQ, it is recommended that the following items, information, and documents be submitted with any modeling analysis:

1. A completed copy of the modeling checklist (Appendix A).
2. A detailed description of the new source's proposed activity. For modified sources, a description of the proposed modification and the source's activity prior to the proposed modification.
3. A detailed description of the proposed new emission or change in emission level.
   a. Point Sources – emission rate, stack height, stack inside diameter, temperature, exit velocity, and nearby building dimensions (downwash).
   b. Area Sources – the height, area/dimensions, and average emission rate per unit area. Road emissions should include the length, surface type, silt content, and location/orientation.
   c. Volume Sources – the release height, initial vertical and horizontal dimension, and emission rate.
   d. Flare Sources – emission rate, stack height, stack diameter, exit velocity, and total heat content.
4. A USGS – 1:24000 scale map showing the location of all sources and receptors used in the analysis.

5. A description of the model(s) selected and why it (each) was (were) selected.
6. A description of the site topography and receptor grids used in the analysis.
7. A description of meteorological data and why it was representative. Quality assurance documentation should also be included. Electronic copies of both ASCII and model compatible formatted meteorological data used in the analysis on 3.5 inch disk or on compact disk.
8. Technical support documentation for any assumptions made in the modeling analysis, which deviated from the GAQM.
9. Model input (regulatory compatible version) and output files in DOS format with file descriptions on 3.5-inch diskettes or on compact disks.
10. A summary of model predictions showing compliance with NAAQS and PSD increment ceilings for both Class I and Class II areas as appropriate. The summary **must include** the information described in the following two subsections:

    a. NAAQS
        1. Table showing pollutants, averaging periods, ambient standards, background concentration, highest (and second highest, if appropriate) modeled concentration, the model used, and the impact location in UTM coordinates.
        2. Concentration isopleth maps with the facility boundary for each pollutant and averaging periods out to 5 percent of the applicable standard, with the ASCII file containing the x, y, and q (concentration) coordinates from which the isopleths were plotted.

    b. PSD Increment
        1. Table showing pollutants, averaging periods, maximum increment consumed by both major and minor sources within 50 km of the subject source since the baseline date, the model used, and the impact location in UTM coordinates.
        2. Increment consumption isopleth maps with the facility boundary, for each pollutant and averaging periods out to 5 percent of the increment ceiling, with the ASCII file containing the x, y, and q (concentration) coordinates from which the isopleths were plotted.

Table 7.1 outlines the required information to be included with any modeling demonstration for NAAQS/MAAQS and for PSD Increment demonstrations.

Table 7.1 Required Information for NAAQS/MAAQS and PSD Compliance Demonstrations

				Receptor Data		Predicted Concentrations			Standards		Compliance Status
Modeled Source	Pollutant Design Conc. (lb/hr)	Avg. Period	Met Data Year	X (km)	Y (km)	Modeled Conc. ($\mu g/m^3$)	Back-ground Conc. ($\mu g/m^3$)	Total Ambient Conc. ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	MAAQS ($\mu g/m^3$)	In/Out
		1-hr									
		3-hr									
		8-hr									
		24-hr									
		Annual									

Additional Required Information for PSD Permit Applications

				Receptor Data		Predicted Concentrations		Standards		Compliance Status In/Out	
Modeled Source	Pollutant Design Conc. (lb/hr)	Avg. Period	Met Data Year	X (km)	Y (km)	Class I Modeled Conc. ($\mu g/m^3$)	Class II Modeled Conc. ($\mu g/m^3$)	Class I Increment. ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)	Class I	Class II
		1-hr									
		3-hr									
		8-hr									
		24-hr									
		Annual									

8.0 References

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APPENDICES

Appendix A - Montana's Air Quality Modeling Checklist

A checklist is an abbreviated protocol for the modeling project; the checklist may be included in with the air quality preconstruction permit application. By using a checklist instead of a protocol, the MDEQ assumes that the applicant is aware of routine modeling practices and procedures. A checklist is less detailed than a protocol and serves to prompt the applicant to consider certain items and procedures, as well as to document them, and to assist in conducting the modeling demonstration.

Use the following checklist in conjunction with the Protocol and Permit Modeling Guidance Requirements, Appendix D**,** as applicable. Enter the required information and mark all items that apply. Include any explanatory information and deviations from standard practice or procedures on the checklist and attach additional pages as necessary. When possible, complete a project specific checklist and send it to the MDEQ before requesting a guidance meeting.

Montana's Air Quality Modeling Checklist

1. Name of Applicant____
   Name of Facility____

2. Permit No.____________________

3. UTM Coordinates of facility: UTM Easting _________ UTM Northing _________
   Zone: _____ Elevation ________ Air Quality Control Region: _________

4. Name of applicant's modeling contact/consultant ________________________________
   Phone number of applicant's modeling contact/consultant __________________________

5. Date of initial contact with Department modeling staff ____________________________
   Name of modeling contact ____
   Type of contact (include dates) phone ________, written _______, meeting ______

6. Was a written modeling protocol submitted to the Department? Yes ____ No ____
   If yes, what date was protocol submitted? __________________________________

7. Is the proposed facility/modification located in a federal nonattainment area?
   Yes ____ No ____
   If yes, for what pollutants?____

8. Has an Emission Summary Table been submitted? Yes ____ No ____

9. Do modeled emissions agree with requested maximum permitted emission levels?
   Yes ____ No ____

10. Were all existing and proposed emissions from this source included in the analysis?
    Yes ____ No ____

11. Is a plot plan summary showing UTM coordinates and the following items included with the analysis? Yes ____ No ____
    - Emission Release Locations Yes ____ No ____
    - Nearby Buildings Yes ____ No ____
    - Property Lines Yes ____ No ____
    - Fence Lines/ Areas of controlled Access Yes ____ No ____
    - Roads Yes ____ No ____
    - UTM Coordinates (shown on axes) Yes ____ No ____
    - Cross Section Directions Yes ____ No ____

12. Are topographic maps showing the following items included with the analysis?
Yes ____ No ____
- Source Locations Yes ____ No ____
- Contour Lines Yes ____ No ____
- Receptor Locations Yes ____ No ____
- Maximum Impact Locations Yes ____ No ____
- UTM Coordinates Yes ____ No ____

13. Are cross-section diagrams included with the analysis? Yes ____ No ____
- Both Buildings & Stacks Yes ____ No____
- At least 2 cross sections at right angles Yes ____ No____
- Supporting photographs of X-sections (if an existing source) Yes ____ No ____
- Signature of person responsible for drawing Yes ____ No ____

14. Are all stack heights at or above GEP stack height? Yes ____ No___
If no, have you included all BPIP input/output data on disk? Yes ____ No ____
Table of buildings as they relate to BPIP identifiers and Plot Plan Report Page No:______

15. Model Selection
a. Terrain modeled Simple ______ Intermediate ______ Complex______
b. Was SCREEN3 used? Yes ____ No ___
c. Was ISCST3 used? Yes ____ No ___
d. Was Building Downwash Modeled? Yes ____ No ___
e. Was the Complex-1 used? Yes ____ No ___
f. Were other models used? Yes ____ No ___
If so, which model(s) was used?____
Why? ____

16. Do the model-input options elected for the analysis agree with EPA's ***Guideline on Air Quality Models***? Yes ____ No ___
If no, explain options used, and why they were selected:____
____

17. Was deposition modeled near the facility? Yes ____ No ___

18. Was the Rural land use designation used in the analysis? Yes ____ No ___

19. Meteorology
a. Was screening meteorology used? Yes ____ No ___
   i. If yes, for simple terrain impacts, was the full meteorology array used?
   Yes ____ No ___
   ii. If yes, was the neutral/unstable mixing height set equal to 1 m above plume height (with a minimum of 320 m)? Yes ____ No ___

iii. If yes, do the screening wind directions include the 36 radials plus "line up" directions (with corresponding receptors for each wind direction)?
Yes ____ No ___

b. Was actual meteorological data used? Yes ____ No ___
   i. If yes, where was the meteorological data collected?
   ii. Surface Site ____
   iii. UTM Easting ________________ UTM Northing __________________
   iv. Upper Air Site ____
   v. UTM Easting ________________ UTM Northing __________________
   vi. Who did you contact within the Department regarding the adequacy of using this data? ____________________________ When? ________________
   vii. Is a Wind Rose illustrating the data provided? Yes ____ No ___ Report Page No:_______
   viii. Did you document periods of missing data and how were they filled in?
   Yes ____ No ___ Report Page No_______
   ix. How many years of meteorological data were used in the analysis? _______
   x. Meteorological years used _____________________________________

20. Receptors

a. Were actual terrain elevations used for each receptor? Yes____ No_____
If yes, what was the source and scale of the terrain elevations?
(e.g., 7.5' USGS maps, 1:24,000 DEM data, 1:250,000 DEM data) __________________

b. Were Cartesian (gridded) receptors used (required when modeling > 1 stack)
Yes____ No_____

c. If coarse modeling was performed, were receptors spaced no further apart than 500 m?
Yes____ No_____

d. Do receptors extend far enough to include the maximum impact location and the nearest terrain at Stability F 2.5 m/sec plume height? Yes____ No_____

e. Was a fine mesh of receptors (spaced no further apart than 100 meters) used to define the maximum impact areas for all averaging times? Yes___ No_____

f. Were receptors placed no further than 50 meters apart along the fence line?
Yes____ No_____

g. Were there steep terrain areas that required denser receptor spacing?
Yes____ No______

h. Were receptors removed inside fenced areas of plant property?
Yes____ No_____

21. Impact Analysis Summary

a. Were the modeling results summarized for each pollutant and for each averaging period?
Yes___ No___

b. Are maximum impacts compared against NAAQS, MAAQS, and PSD increments?
Yes___ No___

c. Are the controlling meteorology conditions summarized? Yes___ No___

d. Are the controlling receptor locations and elevations summarized?
Yes___ No___

e. Were all existing and proposed emissions from this source included in the analysis?
Yes___ No___

If no, why not?____

f. Were ambient background levels included on the MAAQS/NAAQS analysis results?
Yes___ No___

What was the source of the background information? ______________________

g. Were impacts on PSD Class I areas evaluated in the analysis? Yes___ No___

Distance(s) to Class I Areas _____________, ______________, _______________

h. PSD Sources

Were other Air Quality Related Values addressed? Yes___ No___

Was a visibility analysis performed for any Class I area? Yes___ No___

Was a regional haze analysis performed for any Class I area? Yes___ No___

i. Was it necessary to include the impact of other contributing sources on the analysis?
Yes___ No___

If yes, were those sources included on the Emissions and Stack Parameters Summary?
Yes___ No___

1. Have you included input, output, meteorological data, and technical support files along with a detailed description of these files on 3.5" diskettes or compact Disks with your modeling analysis submittal? Yes___ No___

   Are you submitting the following data on diskettes? Yes___ No___

   BPIP input/output? Yes___ No___

   EPA Dispersion model input[4] ready for execution? Yes___ No___

   Dispersion model output[5] Yes___ No___

   Meteorological data (in ASCII format)? Yes___ No___

   Postprocessing programs & files? Yes___ No___ N/A___

   Emissions and maximum impact summary tables? Yes___ No___

.

1 Note: If a proprietary model was used (e.g., IGM), you must still provide model input that is compatible with the EPA equivalent model.

2 Model output should be submitted in electronic form instead of hard copy to reduce the size of the modeling report.

Appendix B - Ratio Techniques

Ratio Technique 1: This technique uses a unit emission rate (1 pound per hour or 1 gram per second) to determine if the maximum contribution from each permitted source when added together, independent of time and space, could exceed a standard. This is a conservative procedure since the maximum concentration from all sources modeled concurrently cannot be more than the sum of the maximum concentration from each source modeled separately.

Each source is evaluated separately with a unit emission rate, such as 1 gram per second; the source's actual location; and the source's proposed stack parameters included in the permit application. For the ISC models this is accomplished by setting up a separate source group for each source. The SCREEN model can also be used for this demonstration by setting up individual model runs for each source.

The maximum predicted concentration for each source is then multiplied by the appropriate emission rate factor for each source and for each pollutant. The emission rate factor is the ratio of the proposed emission rate divided by the unit emission rate.

The sum of the maximum concentrations (for each pollutant, independent of time and space) is then compared with the appropriate ambient standard for each pollutant. If the sum of any pollutant is greater than the standard, then refined modeling may be required

Determining individual source contributions to the ALL source group maximum concentration in the ISC model is not appropriate unless there is only one source or the pollutants are emitted in exactly the same amount for all sources, or pollutants are emitted in exactly the same ratio for all sources.

Ratio Technique 2: One pollutant is modeled for all sources with the MDEQ approved emission rates and stack parameters. Other MDEQ approved pollutant emission rates are then compared with the modeled pollutant emission rate to determine the source that has the maximum ratio. This maximum ratio is then multiplied by the predicted maximum off-property concentration for the pollutant modeled. If the resulting maximum concentration exceeds the standard, then additional refined modeling may be needed.

Appendix C - Estimating NO_2 Emissions

In September 1995, EPA promulgated Supplement C to the GAQM. This revision replaced the Ozone Limiting Method (OLM) (Cole and Summerhays, 1979) with the Ambient Ratio Method (ARM) (Chu and Meyer, 1991), which uses empirically derived nitrogen dioxide to oxides of nitrogen (NO_2/NOx) ratios for estimating NO_2 concentrations that can be applied during screening modeling or refined modeling. The OLM is now considered a 'non-guideline' screening technique, available for use on a case-by-case basis by the reviewing authority.

MDEQ requires that the ARM be used to obtain annual averages of NO_2 from point sources for NSR analysis including PSD, and source review analysis, and for SIP planning purposes. However, MDEQ allows the OLM method to be applied to demonstrate compliance with the 1-hour NO_2 MAAQS. Techniques for applying both methods are outlined below.

Ambient Ratio Method: This method consists of two approaches. One approach applies a conversion factor to the emission rate, and the other applies a conversion factor to the predicted concentration. The process is outlined in the following steps; they do not need to be applied in sequence.

Step 1: Use the NO_X emission rate as a surrogate for the NO_2 emission rate and assume total conversion of NO_X to NO_2. Conduct screening or refined modeling, as applicable. This approach is conservative but is not realistic. If the concentration exceeds the de minimis or NAAQS (with background concentration added), go to Step 2.

Step 2: Apply a conversion factor to the predicted concentration.

Step 2a: Assume limited conversion of NO_X to NO_2. Multiply the predicted annual NO_X concentration by the national default of 0.75. This approach is conservative. If additional refinement is needed, go to Step 2b, if applicable.

Step 2b: Obtain a representative factor for conversion of NO_X to NO_2. Multiply the predicted annual NO_X concentration by a measured NO_2 / NO_X ratio obtained from a site-specific or representative regional air monitor.

Step 3: Apply a conversion factor to the emission rate.

Step 3a: Assume limited conversion of NO_X to NO_2. Multiply the NO_X emission rate by the national default of 0.75; this approach is conservative. Conduct screening or refined modeling, as applicable. If additional refinement is needed, go to Step 3b, if applicable.

Step 3b: Obtain a representative factor for conversion of NO_X to NO_2. Multiply the emissions rate by a measured NO_2 / NO_X ratio obtained from a site-specific or representative regional monitor. Conduct screening or refined modeling, as applicable

Ozone Limiting Method: This method consists of two approaches. One approach applies a conversion factor to the emission rate, and the other applies a conversion factor to the predicted concentration. The process is outlined in the following steps.

Step 1: Use the NO_X emission rate as a surrogate for the NO_2 emission rate and assume total conversion of NO_X to NO_2. Conduct screening or refined modeling, as applicable. This approach is conservative but is not realistic. If the concentration exceeds the MAAQS (with background concentration added), go to Step 2.

Step 2: Apply the following equation to the predicted concentration.

$$[NO_2]_{1\text{-hr}} = \{(0.1) * [NO_X]_{pred}\} + \text{MIN}\ \{(0.9) * [NO_X]_{pred}, \text{ or } (46/48) * [O_3]_{bkgd}\} + [NO_X]_{bkgd}$$

Where:

0.1	The OLM assumes that 10% of the NO_X in the exhaust is converted to NO_2 and no further conversion by this reaction occurs once the exhaust leaves the stack. This assumption is thought to be conservative and should be used in most cases. However, information obtained by MDEQ suggests that for some sources such as diesel powered generators, 30% should be used. Applicants should check with MDEQ before assuming the default value of 10% is acceptable.
$[NO_2]_{1\text{-hr}}$	is the predicted 1-hr NO_2 concentration.
$[NO_X]_{pred}$	is the model predicted annual concentration.
MIN	means the minimum of the two quantities within the brackets.
$[O_3]_{bkgd}$	is the representative 1-hr average ambient O_3 concentration. Absent any monitoring data, the 1-hr O_3 standard, 196 $\mu g/m^3$, should be used.
(46/48)	is the molecular weight of NO_2 divided by the molecular weight of O_3.
$[NO_X]_{bkgd}$	for areas with no other significant sources the annual background concentration is 6 $\mu g/m^3$ and 75 $\mu g/m^3$ for the 1-hr.

Step 2a: If the predicted concentration exceeds the MAAQS (with NO_2 background concentration added) from Step 2 then proceed to Step 2b and evaluate whether the modeled

concentration occurs outside of the O_3 season. If the predicted concentration does not exceed the MAAQS (with NO_2 background concentration added), then the demonstration is completed.

Step 2b: If the peak modeled concentration from Step 2 falls outside of the O_3 season, it is permissible to assume that the O_3 is at 25% of the standard or 49 $\mu g/m^3$ for the background concentration of O_3. Montana assumes the O_3 season is June 1 through October 31. However, the peak modeled concentration during O_3 season must be modeled and Step 2 must be repeated using the 196 $\mu g/m^3$ as the O_3 background concentration to ensure that the standards are also met during O_3 season.

Appendix D - Protocol and Permit Modeling Guidance Requirements

A protocol or checklist serves as an outline to follow to conduct a modeling analysis. Protocols are more formal and more detailed than checklists. Protocols and checklists are generally not mandatory but MDEQ encourages the applicant to submit them for PSD and complex preconstruction permit modeling projects.

The applicant should follow the guidance shown in Table D-1 to develop protocols, or permit modeling guidance checklists. Items in the table apply to all analyses unless noted otherwise.

Table D-1. Protocol and Permit Modeling Guidance

1.0 Project Identification Information

Provide the following information to clearly identify the analysis:

- Applicant
- Facility
- Permit Number (if available)
- Nearest City and County

2.0 Project Overview

- Provide a brief discussion of the plant process(es), and types and locations of emissions under consideration. Attach additional data as applicable for project overview.
- Type of Permit Review - Indicate the type of permit review required by the permit engineer (e.g., PSD, NAA etc.).
- Pollutants to be Evaluated - List all pollutants to be evaluated.

3.0 Plot Plan

Depending on the scope of the project, several plot plans may be needed to present all requested information. Provide a plot plan that includes:

- A clearly marked scale.
- All property lines. **For PSD**, include fence lines.
- A true-north arrow.
- UTM coordinates along the vertical and horizontal borders (Please do not use plant or other coordinates). Provide the datum of your coordinates.
- Reference UTM coordinates and locations of all emission points including fugitive sources modeled.
- Buildings and structures on-property or off-property which could cause downwash. Provide length, width, and height dimensions.

- An indication of the shortest distance to the property line from any of the sources in the facility to be permitted.

4.0 Area Map (More than one map may be required.)

- Add UTMs to the horizontal and vertical dimensions of the map section, as well as the date and title of the map. Provide the datum of your coordinates.
- Annotate schools within 914 m (3,000 ft) of the sources nearest to the property line.
- Any on-site or local meteorological stations, both surface and upper-air.

For PSD Analyses

- Provide a copy of the area map submitted with the permit application. If the map is an extract, it should be full scale (no reduction or enlargement) and cover the area within a 3 km (1.9-mile) radius of the facility if used for the Auer land-use analysis.
- Provide maps that show the location of PSD Class I areas within 100 km (62 miles).
- Urban areas, nonattainment areas, and topographic features within 50 km (31 miles) or the distance to which the source has a significant impact, whichever is less.

5.0 Air Quality Monitoring Data

For PSD Analyses

- Discuss how ambient background concentrations will be obtained. That is, preconstruction monitoring or state/local/on-site monitoring networks. Ideally, conduct the monitoring analysis before a PSD permit application is submitted, as monitoring could take as long as one year if representative monitored data are not available.
- Provide a summary of observations for each pollutant and averaging time, if available.
- Discuss how concentrations will be adjusted, if all nearby and background point sources are modeled in the vicinity of a monitor, if applicable.

6.0 Modeling Emission Inventory

On-Site Sources to be Permitted

Provide a copy of the Emissions Table to be submitted with the permit application. Note that if stack parameters for any averaging period or load level are different, additional entries are required on the Table.

- Identify special source types such as covered stacks, horizontal exhausts, fugitive sources, area sources, open pit sources, volume sources, roads, stockpiles, flares, and how they will be modeled.
- Provide all assumptions and calculations used to determine as appropriate the size, sides, rotation angles, heights of release, initial dispersion coefficients, effective stack diameter, gross heat release, and weighted (by volume) average molecular weight of the mixture being burned.
- Specify particulate emissions as a function of particle size, mass fraction for each particle size category, and particle density for each particle size category, as applicable.
- In addition, it would be helpful to provide a table with stack parameters converted to metric units.

Other On-Site and Off-Site Sources
Advise how other on- and off-site sources' modeling parameters will be obtained.

Table Correlating the Emission Inventory Source Name with the Source Number in the Modeling Output
Provide a table that cross-references the source identification numbers used in the modeling if they are different from the Emissions Table or from any additional list of sources.

Stack Parameter Justification
Provide the basis for using the listed stack parameters (flow rates, temperatures, stack heights, velocities) if known before the protocol is submitted. This should include calculations if necessary for justification.

Scaling Factors
Discuss how emission scalars will be developed and used in the modeling, if applicable.

7.0 Models Proposed and Modeling Technique

Identify proposed models, model version numbers, and the model entry data options such as the regulatory default option and the period option.

- Discuss any proposed specialized modeling techniques such as screening, collocating sources, and ratioing.
- Provide assumptions and sample calculations, as applicable.

8.0 Selection of Dispersion Option

Submit an Auer land-use analysis, if required, for the area within 3 km of the sources being permitted. Base the selection of urban or rural dispersion coefficients on the Auer land-use analysis; however, the population density method could also be used but is not a preferred method

- Provide a color copy of the USGS map, if a USGS map was used in the analysis.

Supplement the topographic map analysis with a current aerial photograph of the area surrounding the permitted sources, or with a detailed drive-through summary, to support a land-use designation, that represents less than 70 percent of the total area evaluated.

9.0 Building Wake Effects (Downwash)

State whether the EPA's Building Profile Input Program (BPIP) or another software package that employs the BPIP algorithms will be used. Provide any computer assisted drawing files.

10.0 Receptor Grid—Terrain and Design

- Discuss if terrain should be considered and how the terrain for individual receptors will be determined.
- Ensure that the higher terrain in any direction from the source is included in the modeling—not just the highest.
- DEM. Provide the datum of your coordinates. If 7.5-minute DEM data are not available for the entire receptor grid, ensure 7.5-minute DEM data are used for receptors within approximately 3–5 km of the property line/fence line.
- Discuss how the receptor grids will be determined for each type of analysis.
- Provide a diagram of each grid and include any reference labels or nomenclature, if available before the protocol is submitted.
- Provide the datum of your coordinates.

11.0 Meteorological Data

- Indicate the surface station, surface station anemometer height, upper-air station, and period of record.
- **For PSD**, five consecutive years of the most recent, readily available, hourly and annual National Weather Service (NWS) data, or one or more years of on-site data.
- Discuss how any meteorological data was determined or replaced, if done before the protocol is submitted. MDEQ should approve substitutions before modeling begins. In addition, submit all the supplementary data used to develop the specific input meteorological parameters required by the PCRAMMET program.

12.0 Modeling Results

- Discuss how the modeling results for each averaging period relative to applicable de minimis values, standards etc. will be presented. Tabulated results are preferred when several constituents are addressed.

For PSD, the following items must also be included.

- **Additional Impacts Analysis,** Discuss what methods will be used to evaluate each of the following: visibility, growth, soils and vegetation analyses, and water, if any, for this project.
- **Class I Area Impacts Analysis,** Discuss what methods will be used to evaluate Class I area impacts, if any, for this project.

Appendix E - Minimum Requirements to Establish Representative Data

A. Physiographic Analysis

Analysis of local terrain features extending out to 1.6 km (1-mile) radius from the site and on a regional scale including several townships for overall impact. The analysis must include the following:

1. Two sites must fall in the same generic category of terrain:
    a. Flat terrain
    b. Shoreline conditions
    c. Complex terrain
        i. Three dimensional terrain
        ii. Simple Valley
        iii. Complex Valley
        iv. Two dimensional terrain

2. For representative sites in complex terrain the following conditions must be similar:
    a. Alignments of major terrain features in north-south orientation
    b. Ratios of height of valley walls to width of valley terrain profiles
    c. Height of ridge to length of ridge
    d. Height of isolated hills to width of hills at the bases
    e. Slope of terrain
    f. Ratio of terrain heights to stack/plume heights
    g. Distance of proposed source from terrain features, i.e., valley wall, ridge, hill etc.

B. Meteorological Analysis Comparison must contain:

1. Comparison of regional meteorology to include typical synoptic weather patterns:
    a. Comparison of site meteorology to include similarity of wind flows, temperatures, inversion types/periods, etc.
    b. Comparisons of the plume rise characteristics for each site.

Appendix F - Monitoring Requirements

DEPARTMENT OF ENVIRONMENTAL QUALITY
PERMITTING AND COMPLIANCE DIVISION
AIR AND WASTE MANAGEMENT BUREAU

OFFICE MEMORANDUM

TO: Permitting Staff **DATE:** October 9, 1998

FROM: David Klemp

SUBJECT: Monitoring Requirements **GUIDANCE STATEMENT**

The Department of Environmental Quality has a responsibility under the Federal and State Clean Air acts to assure compliance with the State of Montana and Federal ambient standards and PSD increments. This assurance is achieved through two mechanisms: 1) emission allowances determined by dispersion modeling analyses conducted during the permit review of new and altered sources; and 2) ambient monitoring. There are circumstances where the modeling or the monitoring alone is adequate to assure compliance, but the law; the regulations and common sense may require the use of both in many instances.

Under the Administrative Rules of Montana 17.8.105, the Department has the authority to require ambient air monitoring, when it is determined to be necessary. This Guidance Statement will identify when it is necessary for the Air Quality Permitting Staff of the Air and Waste Management Bureau to require ambient monitoring for a source. The Permitting Staff are responsible for making the final determination as to when monitoring is required for a source. Once the determination is made for a source, it is then the responsibility of the Permitting Staff to coordinate with the Monitoring and Data Management Bureau - Air Monitoring Section Staff to ensure that all appropriate information is placed correctly in the permit.

This Guidance Statement is necessary to ensure the Permitting Staff are consistent in determining when monitoring is initially required and when monitoring can be discontinued. This Guidance Statement is intended to be applied to all sources, new and existing, with permitted emissions exceeding 100 tons/yr of a pollutant for which an ambient air quality standard exists, with the exception of portable sources, operating in Montana. However, existing sources would not become subject to the requirements of this policy until a permitting action is undertaken that would result in an increase in the ambient concentration above the levels contained in the Monitoring Decision Table (see next page) that would require monitoring. Permitting Staff should not apply this policy retroactively to sources that are not proposing an increase in emissions or ambient concentrations of pollutants.

When determining whether or not a source should be required to conduct monitoring, the Permitting Staff should consider the degree of confidence the Department has in the source's ability to comply with their permit conditions, whether or not a violation of a condition could be readily detected, and the degree of risk that a permit exceedance might result in an exceedance of an ambient standard. The risk factor will be based on the dispersion modeling results used when the permit was issued to demonstrate compliance with the ambient air quality standards. Permitting Staff will consult with Analytical Services Section Staff of the Monitoring and Data Management Bureau in interpreting the modeling results. The table below should be used by the Permitting Staff when deciding whether to require or to discontinue monitoring.

MONITORING DECISION TABLE

Ambient Monitoring Decision Matrix*				
Confidence Level	Percent of Ambient Standard Consumed in Dispersion Model Analysis			
	≤60%	60%--80%	80%--95%	≥95%
High	No Monitor	No Monitor	DEQ Judgement	Yes Monitor
Medium	No Monitor	DEQ Judgement	Yes Monitor	Yes Monitor
Low	DEQ Judgement	Yes Monitor	Yes Monitor	Yes Monitor

*Modeling will be used to determine if monitoring is initially required. Once monitoring information is gathered and available, future decisions such as when to discontinue monitoring will be based on the monitoring results.

HIGH CONFIDENCE LEVEL

Source is located in an area with no known air quality problems for the pollutant(s) of concern and any sources in the area are small and well regulated. Source also has permit conditions that are easily enforceable and the Department could readily determine if the condition was violated. Permitting Staff are confident that emissions are accurately characterized in the permit.

MEDIUM CONFIDENCE LEVEL

Source is in an area with no known problems for the pollutant(s) of concern and any sources in the area are small and well regulated. Permit conditions are not as easy to enforce but the Department still considers them enforceable as a practical matter. The Department can also readily determine if the condition was violated. Permitting Staff are still confident that emissions are accurately characterized in the permit.

LOW CONFIDENCE LEVEL

Source may be in an area with known air quality problems for the pollutant(s) of concern from existing sources. Permit conditions are difficult to enforce and the Department may not know in a timely manner if the condition was violated. Permitting Staff are not very confident that emissions are accurately characterized in the permit.

When the Permitting Staff are making the decision on the confidence level, the appropriate Department staff (i.e. compliance and modeling personnel) should be consulted. Information such as how the limitations are written (e.g., lbs/hr, tons/yr, etc.), how compliance will be determined (e.g., annual source test, CEMS, etc.), as well as the size and location of the source should all be factored into the decision. The final decision as to which confidence level is appropriate shall be made by the Permitting Staff and should focus primarily on whether the Department has determined that a violation of a standard can reasonably occur.

The Permitting Staff should also keep in mind that not all sources can be directly placed in a specific confidence level. Monitoring requirements for these sources will be determined by the Permitting Staff, after consultation with the appropriate Department staff, on a case by case basis. A log of all determinations should be maintained by the Air Quality Permitting Section to ensure that all determinations are made as consistently as possible.

Those sources that are required to monitor may be allowed to discontinue their monitoring if they have collected information for 5 years without an exceedance of the appropriate trigger level in the table and the Department believes that the source is unlikely to cause a violation of an ambient standard in the future. An exceedance of the trigger level only occurs when the Department has determined that the cause of the exceedance is attributed to the source and not an act of nature, an equipment malfunction, or some other reason that cannot be tied to the operation of the source. Permits for sources that have monitoring requirements removed should contain a statement that the Department retains the ability to require ambient monitoring in the future if the Department believes there might be a violation of a standard attributed to a specific source.

Permitting Staff may also make case by case determinations concerning monitoring frequency for sources that are required to monitor. Permitting Staff have the discretion to either increase or decrease the monitoring frequency at a site if conditions warrant. This decision will be made by the Permitting Staff after consultation with the appropriate Department staff and the affected source.

This Guidance Statement is only intended to apply to compliance with the ambient air quality standards and does not apply to any increment. This issue will be handled separately.

This Guidance Statement does not supersede ambient air monitoring required as a result of New Source Review or as a result of any State Implementation Plan.